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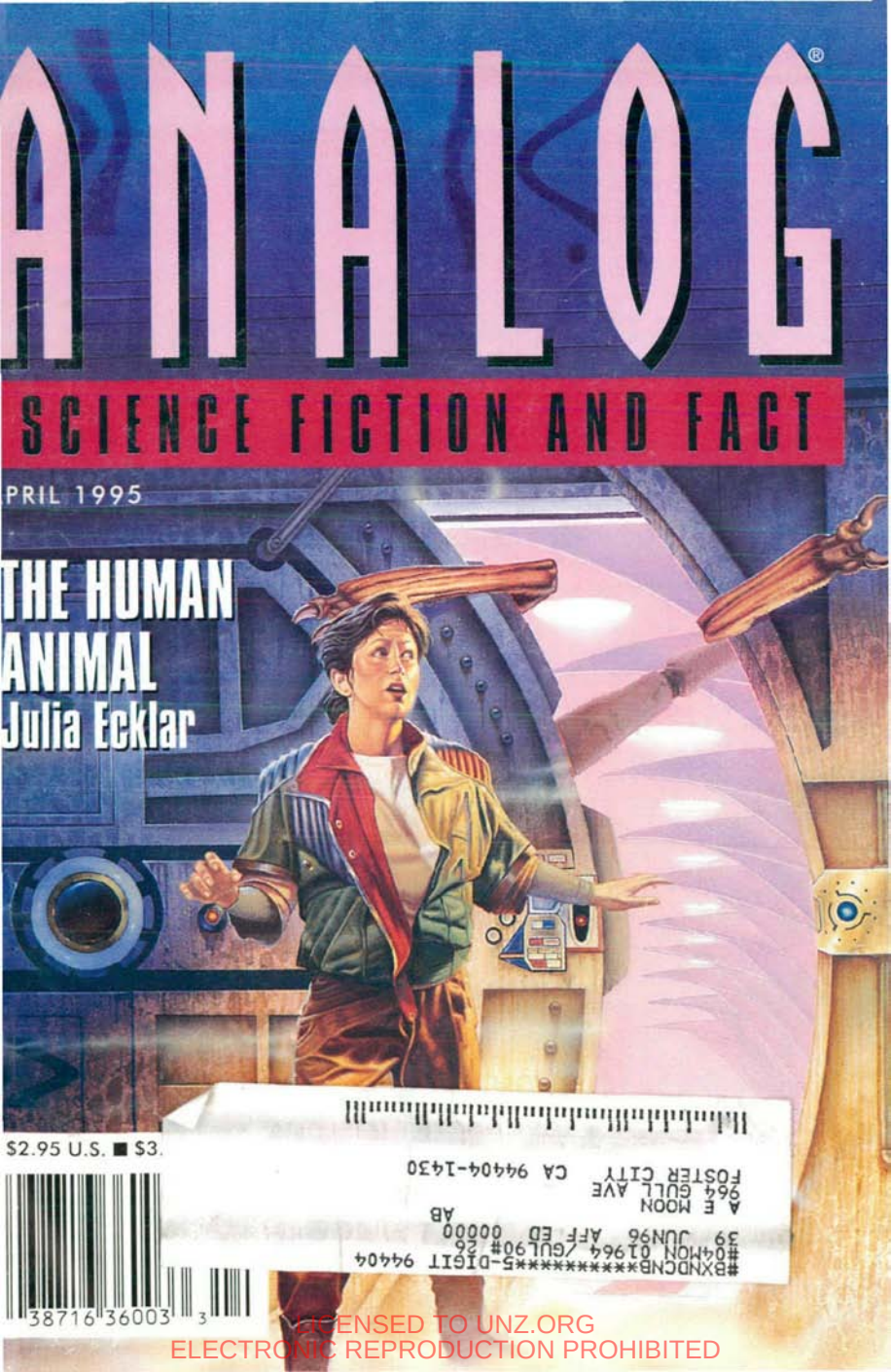
THE HUMAN ANIMAL

Julia Ecklar



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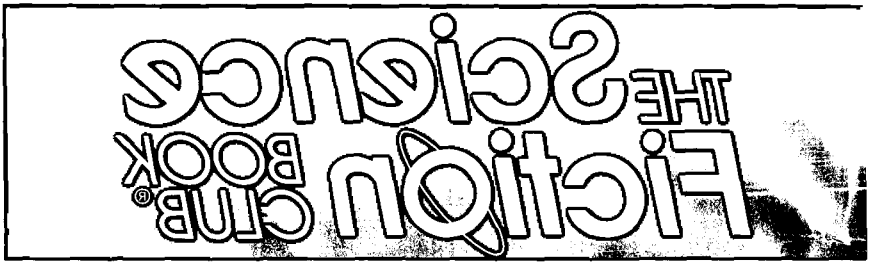

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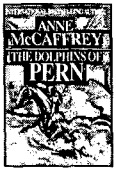

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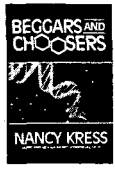

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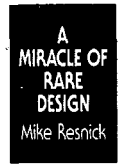

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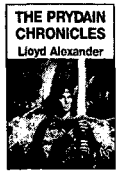

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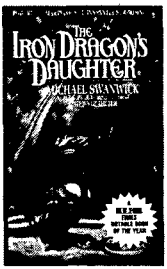

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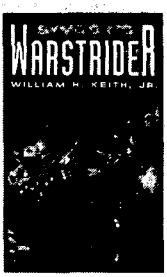

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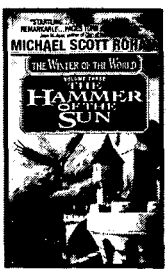

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EDITORIAL Stanley Schmidt

TECHNOLOGY AND TASTE

As last September's World Science Fiction Convention descended upon Winnipeg, Canada, the Winnipeg Art Gallery was just winding up a special exhibit on the life and works of William Morris. Morris, in case you've forgotten, was a 19th-century poet, designer, writer, artist, and businessman. These days he's perhaps best known as the founder of the Arts and Crafts Movement, which the exhibition brochure describes as "an aesthetic backlash against the Industrial Revolution." The exhibition's title, "The Earthly Paradise," was both the title of a long poem by Morris and, according to a guide at the exhibit, a literal description of what Morris and his friends hoped to create.

Morris, it seems, "hated modern civilization." Perennially fascinated with the Middle Ages, he thought the mass-produced products of the Industrial Revolution were tacky and tasteless and the conditions under which they were produced dehumanizing. To a certain extent he was almost certainly right about the latter, though we should bear in mind that he was seeing the *infancy* of the Industrial Revolution. As I pointed out in an earlier essay here ("Primitive Machines," March 1991), the negative qualities people associate with technology are often characteristic not of technology *per se*, but of *primitive* technology.

Morris tried to counteract the problem of working conditions by reviving earlier methods of handcrafting and using only natural materials in his own factories (a word he would probably not like to hear applied to them). As for what his operations produced, the phrase "everything for the home" comes to mind: wallpaper, furniture, carpets, curtains, and just about everything else that could go into interior decoration. He dedicated a large portion of his considerable energies to trying to "restore taste," hoping, in the words of the exhibition brochure, "to instill an appreciation of beauty in the middle and lower classes."

Undeniably, he struck a chord—but missed his original goal. His products quickly gained, and long maintained, great popularity and a reputation for meticulous craftsmanship. Some of them are still made and sold profitably by descendants of his

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original company. Unfortunately, making them to his high standards was so expensive that only the well-off could afford to buy them. In his later years, frustrated by his ironic failure to achieve his dream of making everyone's home a thing of beauty, he became an avid advocate of socialism. If the masses couldn't afford the things he made, he decided, wealth needed to be redistributed so that they could.

Morris seems to have had genuinely good intentions, but it also seemed to me as I explored the exhibition and listened to the guide that he missed two important points.

First, taste is a highly personal thing. I'm not sure how much of the wording of remarks about "restoring taste" was Morris's and how much the exhibition's organizers'; but they did seem to be at least a fair description of what he was trying to do. People who set themselves the goal of cultivating Good Taste in other people usually do it with the best of intentions, sincerely believing that they're doing them a great favor. Unfortunately, it's easy to become pushy and forget that *their* taste does not necessarily define *good* taste in any objective sense. Someone else may genuinely like what I dislike, and vice versa. It is arrogant to presume that this makes them inferior specimens of humanity. I heard no evidence that Morris ever considered the possibility that some folks might have *liked* the very things he considered insufferably ugly—and might have every right to do so.

Second, while the mass-produced products of his time were surely inferior in workmanship to the best hand-made products of the same time, they were in many cases superior to anything most people could afford before mass production. Mass production made it possible for many people to have things they could not have *at all* before—perhaps not of the highest quality, but a widget of modest quality may be far better than no widget at all. Sure, an early recording of a piece of music was a poor substitute for hearing it in live performance by a topnotch orchestra—but the recording made it possible for the piece to be heard by people who could never have afforded a ticket to such a performance.

It might be tempting to view this as the cause of Morris's campaign. When you're rich, it's easy to buy whatever you want, call it the best,

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and sneer at the best others can afford. It's a way to set yourself apart from *them* and thereby feel superior. It's all too easy to conceive of an entrenched wealthy "elite" feeling threatened by anything that makes the advantages they have enjoyed available to more people, thereby reducing their elitehood. A cynic looking at Morris's well-to-do origins and the net *result* of his work might suspect that, despite talk about trying to help the "lower classes," his real intent was to reinforce the distinction between high and low by making still more things that only the former could afford.

This does not seem to have been the case with Morris. He seems to have been genuinely motivated by a desire to improve the lives of as many people as possible, and genuinely dismayed to find that he couldn't make his products affordable for most of them. But it pretty obviously *is* the case with many others, then and now. It often seems to me that discussions of "good" and "bad" taste are really thinly veiled excuses for one group of people to consider themselves superior to another. And, I must add, it works both ways. For every white-collar snob who laughs at pink lawn flamingos, you can easily find a blue-collar snob who laughs at what he sees as the affectations of a restaurant he can't afford.

You or I may not like pink plastic flamingos or highbrow paintings, grand opera or rap, clunky old jalopies or ostentatious limousines; but this does not give us any objective jus-

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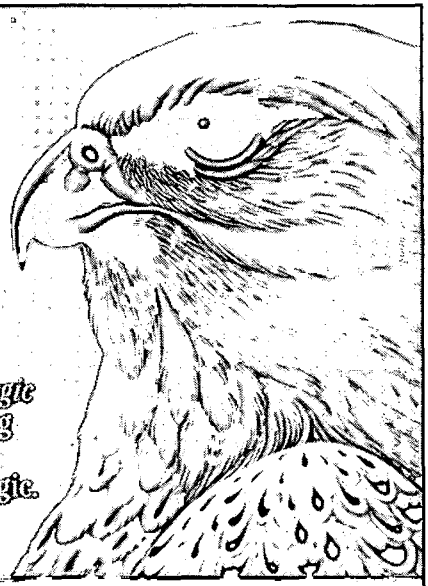
A world in turmoil.

SEAN RUSSELL

WORLD WITHOUT END



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tification for looking down our noses at people who enjoy things we don't or take pride in things we wouldn't. Maybe for you, only the very best car or sound system will do. For somebody else who had a less favored position at the starting gate, the ability to afford a rusty but running ten-year-old Chevy or a discount-store boombox may represent a real accomplishment. It may, in fact, be a more legitimate object of pride than your new BMW or top-of-the-line stereo, if he had to struggle to earn it and you didn't.

And it's well to remember that *neither* of you could have what you have without technology. If you're rich enough, you might be able to have your car or stereo even without mass production; but those less endowed would have to walk and have no music in their homes except what they could make themselves. Most of us could probably use a periodic reminder that this branch of technology has given a great many of us a very significant gift: the ability to have and use things, if only in modest forms, that would otherwise have been completely out of reach.

Finally, I must point out that the capabilities and sometimes the practice of mass production have improved greatly since Morris's time. Products of quite respectable quality can be made, under decent working conditions and without wrecking the environment. Yes, shoddy workmanship, poor working conditions, and waste and pollution are still all too easy to find. But now the blame must be placed on manufacturers too cheap or unscrupulous to do things right, not on the intrinsic inability of machines to do a decent job. Mass production has given most of us many things we could never have enjoyed before; when it fails to live up to its potential, the appropriate response is to attack and correct the specific failings, not the underlying concept of technology in general or mass production in particular.

There's a famous quote by Isaac Newton to the effect that if he had seen farther than others, it was because he stood on the shoulders of giants. We're all standing on the shoulders of different kinds of giants. It would seem ungrateful and ungracious to deride or denigrate them while accepting their support. ■

Old custom without truth is but an old error.

Thomas Fuller

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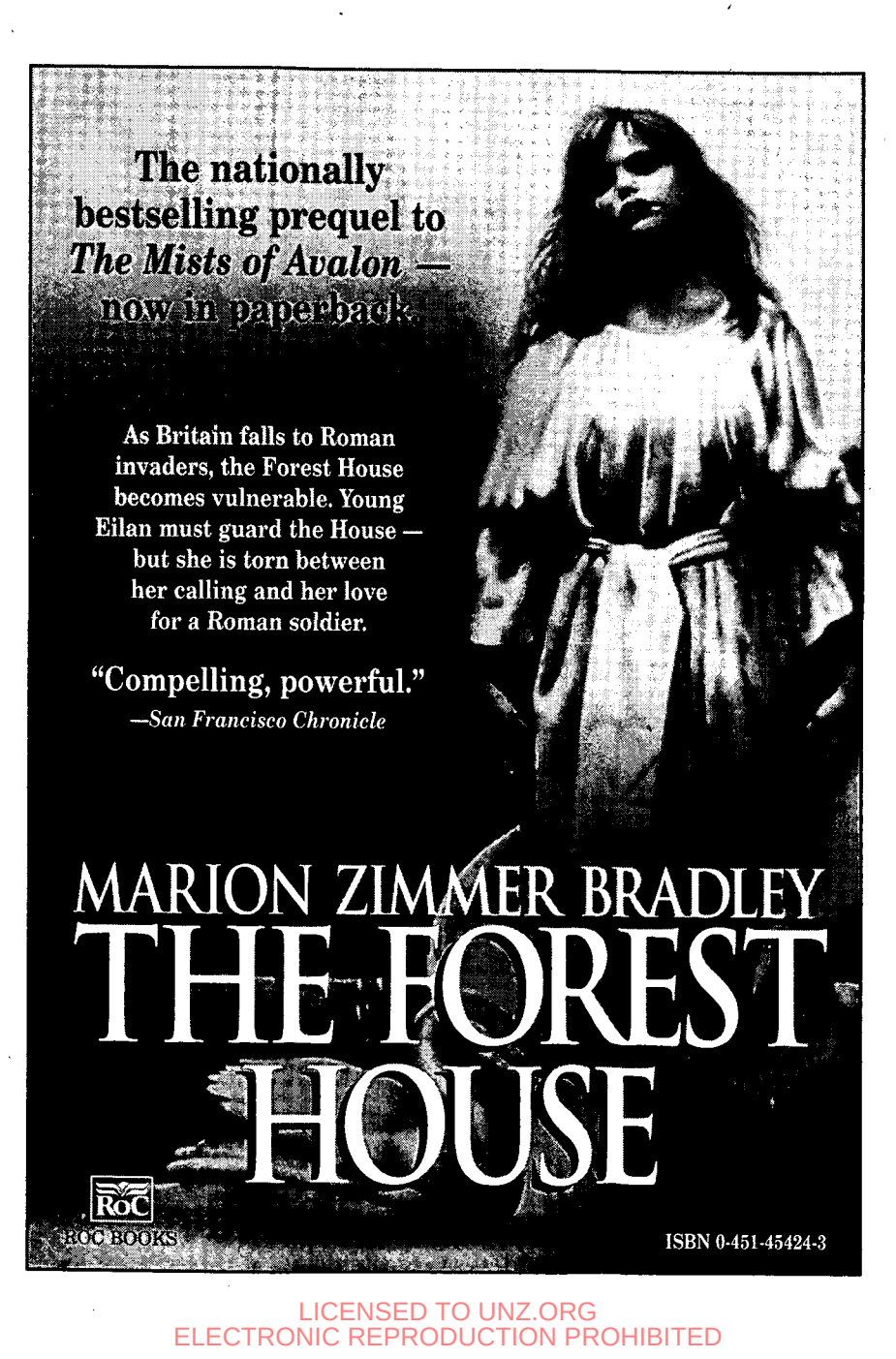
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THE HUMAN ANIMAL

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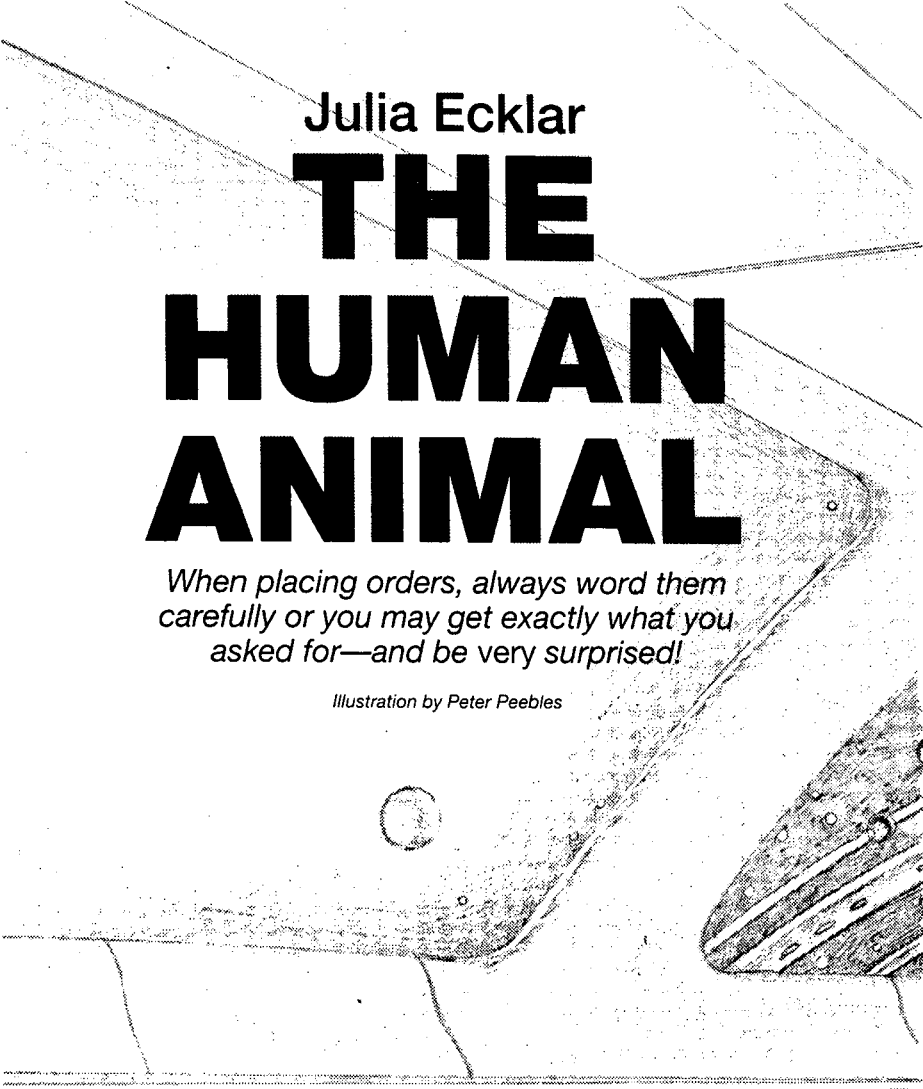

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"I'm sorry, but animals are not allowed on board the Interface."

Rahel Tovin looked at the cluster of robots blocking her path, wondering how many were programmed nobodies, and how many the sentient Newborns who ran Interface station. At least one sported a glossy brass plate riveted over its old Robot Identification Number: MECHANIC. Rahel couldn't help feeling that if she'd had to fight in court to obtain even the most basic "human" rights, she would have picked a better name than her previous job.

"Interesting house rule." On the ground beside Rahel, Toad hit the end of her lead and snuffled all over Mechanic's treadmill, pretending not to be leash-broken. "Sounds kind of like an anti-carbon bias to me."

"On the contrary." Mechanic rolled straight backward and stranded Toad at the end of her line. The drones to either side didn't move, but Toad still cocked her head attentively from side to side, as though sure they were about to do something fascinating. "The regulation was established at the request of several carbon-based lifeforms who frequently ply their trades on the Interface."

"Animals restricting animals?" Rahel tucked one foot under Toad's broad, brindled ribcage, and used it to slide the puppy back toward her. "That's pretty funny."

"Sentients restricting animals," Mechanic countered smoothly.

A yellow playback light blinked into life on the shoulder of one of the drones, and a flat, overly-loud voice reeled forth from its chest speaker. "Any self-motivating life-form judged incapable of making informed decisions regarding its own safety or the safety of others shall be defined an animal and restrained accordingly."

Mechanic extended a manipulator arm, and Toad's ears flicked forward with interest. "Visual reference identifies this as *Canis familiaris,* breed unknown, age approximately four and one half Standard months. You lead it about on a leash, indicating you fear its behavior should it pass outside your influence—"

"I fear she'll piddle all over your space station, that's what I fear."

"It is the opinion of the Interface that the lifeform in your possession is an animal. We must ask that you remove it from the Interface, or it will be impounded."

"The opinion of the Interface, or the opinion of your sentience bigots?" Rahel didn't really expect an answer. Mechanic didn't offer one. Its optics clicked focus between Rahel, the puppy, its drones, while the drones themselves waited with programmed patience for something decisive to happen.

Ten meters down the corridor, a tall, grey-brown creature sidled into sight from behind a structural support. Combing rear legs over its velvet-furred abdomen, it chewed at its uppermost appendages while the eyes in its thorax glittered attentively. It looked like a melding of centaur and mantis, minus the exoskeleton and plus an additional set of pincer arms around the area of its waist. When it saw Rahel studying it across the distance, a shiver of distress trem-

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bled through its multi-jointed limbs and it scurried forward to crouch behind the line of robots, weaving nervously.

"Worry. Pungent. Breathing. Worry." The clean, Standard words —so expressionless and mechanical—obviously stuttered forth from the knobbed and fluted cylinder the spindly creature scraped erratically across its underside. Whatever concepts were supposed to be transmitted by the words was just as obviously alien in origin. "Animal. Yes? Animal. No?"

"This is a puppy," Rahel said clearly, hoping the alien's translator device had some means of sending language the other way. "A dog, domesticated by humans almost since day one." Toad stretched her neck out as far as thick terrier muscles would allow, groaning at the prospect of never exploring those thorny alien legs. "You wouldn't recognize her breed even if I told you what it was—it was extinct up until six months ago."

A flutter of movement marked the passing of translator rod through two sets of appendages to some orifice at the top of the creature's thorax, then back down to its belly again. "Inside-in-food-protect-living no. Answer. No."

Mechanic translated simply, "Domestication is not an issue."

Rahel scowled up at the alien and it skittered backward in apparent alarm. "What? You don't domesticate animals?"

"Breathing. Not-think. Smelling frighten. Abomination."

This time, Mechanic didn't offer a clarification.

"Look," Rahel sighed to the Newborn, "you guys set up this space station so various species could negotiate trade agreements, right? Well, I'm here to talk to some people about trade, just like you want." Rahel gathered up a fistful of leash and pulled the puppy a few sliding steps closer when Toad cocked her head as though contemplating another approach on the alien. "She's free of parasites and diseases, and I won't let her off the leash. I'll even put a diaper on her, if that'll make you happy." Toad would just love that. Still, the brass at Noah's Ark would kill Rahel if she got kicked offstation all because of a puppy and some touchy alien.

If Mechanic could shake its head, it probably would have. Instead, it snaked out an arm and pinched Toad's leash between two fingers. Rahel tightened her own grip on the bundle when drones closed in on either side, and Toad leapt to her feet, whip-like tail slicing the air into shreds of doggy delight at the very suggestion of play. The alien minced a half-meter closer to chew on its own hands.

"To avoid seizure of this animal, you must leave it on your transport," Mechanic instructed Rahel. "Your transport must then remain disconnected from the Interface and parked no less than fifteen thousand kilometers away."

"You've got to be kidding." Rahel avoided picking up Toad as a rule—she'd be a thirteen-kilo terrier when she was full grown, and

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shouldn't get used to being carried around—but she stooped now to tuck the puppy protectively under one arm. "There's nobody to pilot my jump if I'm not there. I travel alone."

"Perhaps that's something you should rectify before you revisit the Interface."

"Look. . . . " She reached to twitch the leash out of Mechanic's grip, but the alien behind the Newborn was faster. Pinching a roll of white-and-brindle skin in the longest of its thorax pincers, it dragged Toad forward by one jowl and one ear, frightening a piercing scream from the puppy. Rahel's heart lunged for her throat. She hugged Toad like a mother bear and twisted her shoulder to the creature, striking out at the same time to grab the alien hand and thrust her thumb into the hinge of its largest joint. It felt like grabbing the mummified remains of a snake. But like a stubborn horse's jaw, the grip popped almost reflexively open, and Rahel scrambled two long steps backward before either alien or robots could reach toward her again.

The creature's legs bent into sharp peaks, and it sank almost supine behind the line of robots, its thorax curled down across its back. The translator beneath its belly groaned and stuttered, but didn't offer forth any words. Just as well. Rahel wasn't in the mood for its explanations, anyway.

"I came a couple hundred light-years to do business at your station," she told Mechanic, still hugging Toad. The puppy had crammed herself as small as caninely possible, her head burrowed into Rahel's armpit and her tail sleeked between her hind legs. "I'm willing to leave the dog on my ship if that's what the Interface wants me to do, but if you think I'm going to let some chicken-shit extraterrestrial—"

"If you behave violently toward any other denizen of this station," Mechanic said in a voice too artificially calm to ignore, "we will deport you and forbid your return for up to one hundred Standard years."

Rahel wondered fleetingly if the Newborn meant her personally, or humans in general. She'd no doubt become very unpopular if she got her entire species banned from one of the Galaxy's main mercantile stations. It wouldn't do much toward helping her locate her poachers, either, since Noah's Ark hadn't been able to verify Terran animals being sold black-market anywhere but at the Newborns's Interface. Curling the fingers of her right hand, she tried to hide the frustrated gesture by gathering up the rest of Toad's leash in that fist.

"I'm sorry if I behaved violently." Rahel aimed for that air of civility that made her teeth grate when she heard other people use it. Having to force the words out at all almost made her want to kick the cowering alien. "I was only trying to safeguard my property against what I thought was violence from . . . " she wasn't sure if either "him" or "her" was applicable, so settled for, " . . . your companion. It hardly seemed reasonable to attack me that way, since I know for a fact that mine isn't the only ship docked at the Interface with animals on

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board."

The moaning hiss from the alien's translator fell silent.

A 'link light flashed beneath Mechanic's face-board, then went dark again. "That information is incorrect."

"Like hell it is." Or maybe that would be considered violent again. It was so hard to tell with inorganics. Rising up on tiptoe, Rahel scowled left and right across the river of Newborns and extraterrestrials pouring down the hallway to either side. She'd seen the string of elaborately decorated jumpships while she was parking her own ship, so knew a caravan was on station—it was just a matter of finding the scream of eye-aching color in the swarm of businessfolk around her.

As it was, Rahel heard the rhythmic *jing-jing-jing-jing* of a quadruped scratching a ring-spangled ear before she actually turned and caught sight of the alien felid. She aimed Mechanic's attention at the bored duac who now sat pulling at the nails on its hind toes. "What do you call that?"

The alien lifted itself to full height again, and Mechanic's primary optic extended to adjust its focus. "That is a duac," the Newborn said.

As though recognizing the word, Toad squirmed in Rahel's grip and sneaked a timid look. Just what Rahel needed—her puppy slobbering all over the mazhet's dun cats, chewing on their tall, upswept ears and barking at their profusion of nose, toe, and ear rings. She tightened her elbow until the little dog grumbled with renewed disappointment. "That duac is here with the mazhet—not even on a leash, I might add, or at its mazhet's side." In fact, the mazhet in question was nearly out of sight beyond the door of some small, over-lit curio shop. Only the occasional flash of puce, violet and vermillion robes —overspread with meters and meters of gold chain—betrayed the mazhet's position when it gestured. "How come the mazhet get to let their duacs wander free while you and your cringing arachnid give me grief about one domestic puppy on a leash?"

Mechanic turned its optics away from the duac in a dismissal that was clear even without expression or tone of voice. "The mazhet have a special arrangement with the Interface."

Of course they did. The mazhet had a special arrangement with everybody.

Rahel rubbed at her eyes. "Then what about Comtes Nadder?"

"Interface registration lists Comtes Nadder's ship *Medve* as a specialized class three transport." Mechanic consulted the station's database for another few blinks of its light. As though encouraged by Mechanic's control of the situation, the alien behind the robots rose creakily to full height again. "Comtes Nadder is a licensed dealer in exotic goods."

That much Rahel knew—she was supposed to have been at Nadder's berth fifteen minutes ago to discuss a transfer of livestock.

"Exotic dealers are encouraged on the Interface, as they stimulate trade and interspecies goodwill." Whatever moved Newborns to *care* about inter-

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species goodwill was a mystery to Rahel, not to mention half the rest of the Galaxy. Maybe the Newborns reacted to some sort of perceived social inequality that non-chip-driven sentients weren't sensitive to. Or maybe goodwill just promoted good trade, thus guaranteeing the Newborns enough money to buy the parts, programs, and power they needed to stay running without selling themselves into slavery. Rahel didn't care which.

"Nadder's 'exotic goods' are animals," Rahel pointed out to the Newborn and its alien eavesdropper. "She's docked with this station in a ship twice as large as mine, and her whole cargo bay is stuffed full of live animals. Goodwill or not, you just told *me* that's illegal."

The alien rubbed at its eyes with all four arms, and its translator squealed. Mechanic was not so nonplussed. "*Medve*'s cargo is not prohibited under Interface regulation 4731 Section 2 Paragraph 7. As specified in this free trade statute, *Medve*'s cargo qualifies as merchandise, not animals."

Rahel stared at the Newborn for almost half a minute. Behind it, the alien bobbed twice, silently. "You mean if I was here to sell this dog, then it would be OK for me to have her onstation?"

"This animal would then be classified as legal merchandise under the Interface statute referenced above."

"Well, what do you know?" Rahel snorted a laugh, then brought her face under control. "It just so happens that I came here planning to sell her."

The alien shuddered as though struck with a cold breeze, and one of the drones rolled away. Mechanic asked, "Do you have papers attesting to these plans?"

Rahel scowled, squatting to let Toad wriggle loose and hop back to the floor. The puppy oozed behind her to get out of the alien's sight. "Not everybody needs papers to prove they do fair trade." Rahel bobbed up on tiptoe to search the crowd around the mazhet's multi-hued skirts. "I can give you references better than any set of papers." Assuming mazhet memory worked at all the way rumor suggested it did.

Rahel found the *dhaktu* right where she'd expected—stone-still to the mazhet's left, hands laced passively behind his back while he waited to translate the mazhet's alien clicks and rattles. The shaven head and simple rose-orange-lavender tunic marked him as a mazhet employee; the remnants of an ash-blond topknot marked him as human, and still young enough to not have grey in his hair. Whatever discussion the mazhet conducted inside the little shop, the human didn't seem to be involved, or even very interested. When the duac threaded its lazy way between patrons to rejoin the mazhet, the human *dhaktu* didn't so much as glance at the cat. Rahel wondered how long *dhaktu* had to practice before perfecting the details of their self-imposed invisibility.

"Hey!" She whistled shrilly. The duac turned to swivel ears in Rahel's direction and Toad barked a greeting, but neither human nor mazhet moved. "Invisible Voice!" This time,

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the *dhaktu*'s spine jerked even more stiffly straight than before. "I need to talk to your boss. It's kind of important."

"Ms. Tovin—" Mechanic poked at her kneecap with the end of one retractor arm. "Such shouting is considered socially unacceptable in many sentient cultures, including your own." Toad stretched up to lick the Newborn's gripper.

"Well, if we're lucky, I won't have to do it again." Rahel gathered up the slack in Toad's leash when she saw the *dhaktu*'s hand creep forward to pluck the webwork of chains depending from his mazhet's sleeve. Although nothing physical seemed to change in the alien's stance or attitude, Rahel felt the mazhet's shift in attention almost as clearly as the *dhaktu* must have. Tipping forward as though pushed delicately from behind, the *dhaktu* whispered into the back of his mazhet's shoulder—as close as he could come to the tall alien's head. Then they both turned in a neatly executed whirl of ribbons, bells, and clashing fabric, and the mazhet glided out into full view for the first time.

Except for the colors and patterns in their obstreperous robing, mazhet seemed truly indistinguishable from each other as far as Rahel could tell. They stood a nearly uniform two-and-a-half meters in height, their huge eyes an identical, whiteless ebony, their skin always the same shade of luscious burnt mahogany. If their humanoid faces had been constructed with a breath more subtlety, they wouldn't have had faces at all; if their skin had kissed their bones more closely, they'd be nothing but a collection of brittle sticks, artfully arranged to resemble a man. And if any mazhet anywhere had ever displayed something reminiscent of a human emotion, Rahel had yet to hear about it.

She tucked the puppy between her ankles, holding Toad with the gentle pressure of her legs as the mazhet approached.

"Ayr." Mechanic spoke the single word as a name, pivoting on its treadmill to face the mazhet. The mazhet inclined its head toward one shoulder with a faint jingle of jewelry, but gave no other sign of greeting. It offered no acknowledgement at all to the shivering mantis-alien. "This woman wishes to bring an animal on board the Interface for purposes of barter. She claims you can serve as her reference."

Rahel waited until Ayr turned its face toward her, then clenched her fist apprehensively in the tangle of leash. "Do you know who I am?"

Ayr blinked slowly, and the duac stretched itself into a C around Rahel's legs to snuffle at Toad's backside. If the mazhet even flicked a glance down at the felid, Rahel couldn't tell—she hadn't yet figured out how to judge when mazhet focus moved.

A short, startling burst of clicking prompted the *dhaktu* to take a step forward. "This human is known to the mazhet." The *dhaktu* spoke as if the words were wholly his, but he never moved closer than his mazhet's left elbow, and he never made eye

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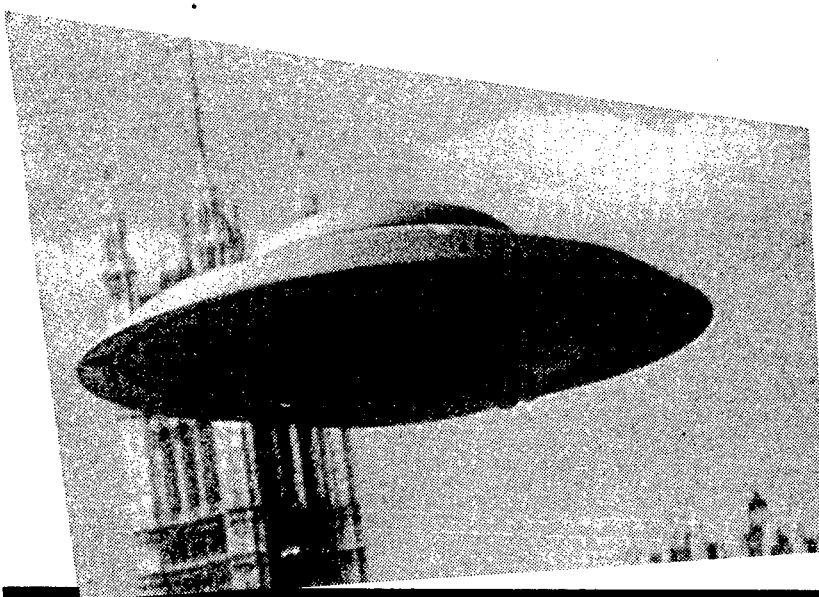

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contact with anyone. Even the mantis seemed to keep its attention locked frantically on the mazhet.

Rahel forced herself to stare directly at Ayr. The alien's intricate bodice reflected like wine in its eyes. "Did I conduct barter with the mazhet on Reyson's Planet for the exchange of exotic animals?"

Although she had never seen or heard of Ayr before a few moments ago, its barrage of hissing clicks passed on through the *dhaktu*'s mouth as, "Such barter with this human did occur."

Mechanic watched the duac circle Rahel slowly, stubby white tail flicking in time to its toe rings against the floor. "Do the mazhet accept this woman as competent and capable of managing the animal in her possession?"

The duac finally snorted with boredom and wandered away. The mantis-alien jittered out of its way before the cat came close enough to touch it.

Toad craned her neck to watch the duac leave, although neither Ayr nor the *dhaktu* seemed particularly concerned about the big cat's departure. "This is accepted by the mazhet."

"Very well." Mechanic squawked a blat of machine language, and its bevy of drones rolled off in separate directions, mindlessly intent on new places and new things. The mantis turned in a circle, watching them go. "The Interface hereby issues this temporary livestock merchandise transporting permit, valid until eighty hours from moment of issue." A scrap of flimsy curled out of a slot in its stomach. The Newborn rolled a half-meter forward, apparently offering the printout to Rahel. She tightened her grip on Toad before bending to take it.

"You must carry this permit with you at all times while on board the Interface with this animal. If at any time you cannot produce this permit on demand, the animal in question will be confiscated. Say yes if you understand."

Rahel nodded and tucked the flimsy into her trouser pocket. "Yes." She flicked a look at the alien still twirling in distress behind the remaining Newborn. It muttered into its translator without looking at her.

Mechanic's 'link indicator twinkled briefly. "So logged. Enjoy your stay at the Interface." It rotated and trundled off around the corner before it had even finished speaking to her. Rahel couldn't help wondering if Comtes Nadder and her shipload of illegal animals had gotten as much hassle the first time *Medve* tried to set up shop on the station.

"Proctor Tovin. . . . "

Rahel nearly collided with Ayr when she turned, finding herself for the first time close enough to a mazhet to smell the dusty perfume of its robes. Ayr angled its head to blink down at her, and Rahel took two unconscious steps backward under the pressure of those pupilless black eyes.

"Always has your employer censured mazhet trade in obsolete genotypes." Rahel wasn't sure how much of the innocent curiosity in the words came directly from Ayr, and how much was supplied by its *dhaktu*.

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"Does Noah's Ark seek now to busy itself in the barter of such exotic animals?"

Rahel slid Toad down to the floor. The puppy immediately busied herself snuffling the mazhet's feet and ringing its adornments with her tail. "I'm not here in my capacity as a Noah's Ark proctor. This is more like a private business matter that I'd rather not discuss." She twisted to look over her shoulder, but the insectoid alien had already backed halfway down the long corridor, its hands back in its mouth. "Do the mazhet know what that is?"

"That is Larry."

If the mazhet weren't naturally constructed to be so deadpan, Rahel might have taken that as a joke. "Larry?"

"He is tlict, and deals not often with human beings." Ayr raised its head to make contact with the departing creature, closing both fists in front of its mouth in some sort of gesture of greeting or farewell. "Tlict identifications cannot be rendered audibly. All male tlict, therefore, respond in the human language to the identification, 'Larry.' "

Rahel watched the tlict pick its way gingerly through the deepening crowd. "Then what am I supposed to call the females?"

The *dhaktu* laughed. Or maybe it was the mazhet after all. Who knew what they used as a natural expression of humor? "You will not ever see a female tlict," the mazhet told her with a graceful wave of its hands. "And if you do, Proctor Tovin, you will not see a human again to talk about it, so what you do or do not call her hardly matters."

Comtes Nadder's docking berth smelled of ammonia and gamey animal breathing. Rahel assumed this was on purpose. After all, *Medve* itself must be as airtight as any other ship in the void, and Nadder certainly hadn't allowed her stock to wander out where prospective buyers might catch a premature glimpse of the offerings. The black-marketeer no doubt wanted customers to be confident that her livestock ate, breathed, and shat just as much as the most legal reproductions. Conversely, Nadder probably would have had the berth smelling as pure as a Newborn's bottom if she'd known Rahel was a Noah's Ark proctor. So maybe the godawful stench was in truth a good sign after all.

Rahel stopped outside *Medve*'s airlock and palmed the signal. Toad made bored circles around her ankles, sighing at her predicament when the leash finally cinched too tight for her to move. "It's called aversion therapy," Rahel commented aloud.

As if in response to her voice, *Medve*'s hatch whisked open. "You're late."

Rahel had expected the accusation, but not the whippet-sparse figure who delivered it. Her hand braced impatiently against the airlock hatch, Comtes Nadder looked older and more sallow than Rahel had imagined in their comlink talks. The deep, rust-edged voice was the same, though, and the black leather jumpsuit and red headband seemed at least as care-

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fully chosen as the smuggler's waist-length black hair and garnet eyes. Not necessarily a flattering combination, but effective enough, considering Nadder's occupation. Rahel suspected the other woman wasn't much of a slave to current fashions.

Trying on an arrogant scowl, Rahel stepped free of Toad's leash with the ease of much recent practice. "I tried to get here sooner, but the Newborns caught me coming onstation with the dog and gave me some 'no animals' song and dance. It took a while to get past them."

"Yeah, I hear you." Nadder flashed a smile as thin as her face, and stepped away from the hatch to let Rahel past. The inside of *Medve* didn't even smell like people, much less like wild animal feces. One more illusion shattered.

"Next time," Nadder said, closing the lock behind them and leading the way into the rest of the ship, "tell the Newbies she's cargo. They don't care what you're really carrying, so long as you give 'em the papers they want."

As if that much weren't apparent simply by Nadder's presence here. "I told them she was merchandise." Rahel tried very hard to sound cursory about the falsehood. Knowing the extent to which Nadder abused the same loophole in Newborn regulations, though, made her words come out disdainful and angry.

Which seemed to work just as well. "So is she?" Nadder brushed an intent glance across the puppy, shouldering open another door.

Rahel tightened her grip on Toad's lead. "Is she what?"

"Merchandise. Did you bring her here to sell?"

Cold day in hell before I let any animal go with you. "No. She's a pet project of mine—I only just got her myself."

"Too bad." Nadder paused outside the great double hatch of *Medve*'s cargo bay, punching some lengthy code into the lock while her body kept Rahel from seeing anything interesting. "I'd love to have a shot at her chromosomes. There's not a lot of choice in extinct dogs on the open market, and she looks about as Terran as they come. Oh, well." She pushed open the door with another nanosecond smile. "We can talk again after you see what I've got. Maybe we can cut us a deal."

Or maybe not. Rahel followed her into the cargo bay, pausing only long enough to bounce Toad up into her arms.

Rows and stacks and walls of crates stretched a startling distance in all directions. No distinctive markings to separate one steel container from the other, though. Not even a manifest pad left hanging near an inventory port that Rahel could steal a peek at. Just a loader drone backed into its parking station and whatever webbing and antigravs were necessary to hold the cargo in place. Rahel swallowed a curl of annoyance. For all she knew, Nadder's boxes could be filled with party condoms, on their way to the mazhet embassy.

"I thought you said you had animals."

"Oh, I've got animals." Nadder waved her toward a comp station

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along the starboard wall. "I've got whatever animals you want. Sit down."

Rahel sank into the station's only chair, lacing her arms across Toad's back to encourage the puppy to lie down. What she'd taken from the doorway to be a smart loading system revealed itself instead as a gangling collection of I/O interfaces, headbands, and gloves. Rahel picked up the closest optic projector and let it dangle from her index finger. "I had something a little more concrete in mind."

Nadder shrugged as she dug another set of VR equipment out of a drawer. "While you're on my ship, you do my business, my way." She wiggled her hand into one of the gloves. "I've been doing this longer than you've even been around, honey. Don't try to teach me new tricks."

Nadder's VR simscape was built on cheap stock background coding. Nondescript trees of a deciduous nature rustled without moving, birds from various climates and planets twittered and sang without deigning to make an appearance. Rahel's feet and hands and torso manifested as little more than an idealized mannequin, and the VR channeled nothing back by way of sensory input except for the occasional sound. Just as well. Captured by the VR's manufactured visual frame of reference, she already felt refracted from her physical body—she didn't need the rest of her senses lying to her, as well.

"So what happens here?" Rahel felt Toad walk a circle in her lap. The weird division of her attention made her dizzy.

"Here, you get to look at anything available that strikes your fancy. For as long as you want, and as close as you want." Another featureless mannequin appeared against the simscape. Rahel thought the effect a lot more gruesome now that she was confronted with the golem in its entirety. "What are you interested in?" Nadder asked through a lipless mouth.

Rahel shrugged, then realized such a subtle gesture wouldn't be picked up by her simulacrum. "What have you got?"

"They're listed by family down below."

Sure enough, a multi-layered tap menu floated in an arc at her waist level. Rahel hesitated with her hand spread above the choices, like an uncertain god. The number of species represented in that color-coded strip would have filled the Breeding Compounds back at Noah's Ark for generations. From there, they would go on to freedom on new homes throughout the Galaxy, new histories for their young. What kind of life did they have to look forward to from here? Illegal purchase by the Galaxy's filthy rich, and a decidedly substandard existence in some private exhibition where they would never know the dignity of self-sufficiency, never know the company of their own kind.

Rahel tapped out a family at random, found only one genus underneath it, and only one species under that. She called up the choice without reading it. Whatever it was didn't mat-

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ter—it was the fact that Nadder had a copy of it when it didn't exist anymore that made it significant.

The bad stock simscape flashed away, replaced by a more detailed reconstruction on an up-close-and-personal scale. Dark, serrated leaves dropped over a slip of muddied rock, and a transparent grey mass crept across at Rahel's eye level, its creamy rust-and-white shell balanced as delicately as a teacup on its nonexistent shoulders.

"Partula exigua." Nadder sounded very close, but didn't appear in Rahel's view of the scene. "Interesting choice. Go ahead—pick it up."

Rahel lifted the chip of stone across which the little snail labored. It continued crawling with no knowledge of its relocation. *That's because it isn't real,* Rahel told herself. *It's just a little computer worm that's supposed to look good and rake in buyers.* She couldn't feel the cool kiss of its flesh when it oozed onto her fingers, couldn't feel the chalky smoothness of its shell when she traced its dextral swirl. She'd never before held an extinct animal in her hands and believed so keenly in its absence—like weaving with shadows, or fondling air.

"Partulas are a nice choice if you've got space limitations," Nadder was saying, her voice moving around the sim even though she didn't materialize. "They move maybe thirty centimeters a year—a half-meter, tops—and they even eat their own crap, so you don't have to clean up after them. Feeding for this guy's your biggest problem. He's strictly carnivorous, and won't eat anything except a particular family of snails that are about as easy to find as he is." Her hand appeared for the first time, there only long enough to pluck the partulid from Rahel's fingers, turn it, and replace it on her palm headed the opposite direction. "He'll live off a specialized protein gel for a while, but partulas have a tendency to starve to death before they'll eat anything new." The spiel sounded well-rehearsed, Nadder's voice slightly distracted as she recited it. "Your best bet would be to work out some kind of supply deal with me. I can send the same kind of snails he's been eating here whenever you say you need 'em—in a non-breeding variety, of course."

Of course. Rahel carefully tickled the snail off her palm and back onto the virtual mud. It bounced onto one side when it met the ground, cringing back into its shell until only the tips of its slow antennae floated ahead to feel for danger.

Rahel righted it gently with the side of her thumb. Even knowing it was virtual didn't save her from feeling guilty for having startled the little snail. Rahel couldn't force herself to be cavalier about any creature's welfare, even when she knew the creature was only make believe. This particular virtual specimen, at least, presumably represented some live individual, hidden amongst Nadder's extensive cargo. Keeping that in mind, Rahel tapped the snail's spiral shell to see if that would give her additional information on the species.

A submenu exploded upward from

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the partulid's location. A bright yellow rectangle, outlined in red, hung in front of her face long enough to blink ACCESS RESTRICTED four times, then diminished into a point again and vanished. Rahel twisted her mouth into a frustrated scowl, but resisted actually swearing out loud.

"What the hell was that for?"

She glanced up for Nadder's simulacrum before remembering she was in this VR 'scape alone. "Just browsing. I was curious about things like the snail's original climate, altitude, mineral requirements—"

"DNA spins?"

Rahel called up a sample of *Alytes obstetricians* in an effort to hide her surprise. "Whatever you might have had on tap," she said with feigned nonchalance.

Light shattered across the simscape, dashing apart the pieces of unreality and leaving Rahel blinking at the sudden solidity of the cargo bay around her. Nadder pitched Rahel's optic set at the VR station, then didn't bother bending to catch it when it slid off the panel and onto the floor. She left that to the silent, white-haired man behind her.

"Chat over." Nadder tugged the headset from the albino's hands and threw it back onto the station. This time it stayed. "Vacate the ship like a good girl, proctor, and we'll call this barter even."

Rahel stood slowly, Toad kicking unhappily until she turned her to a more stable position in her arms. "I didn't even get to see what I was looking for."

"You've seen enough."

Not nearly.

"Don't you guys have better things to do?" Nadder asked as she gestured oh-so-politely toward the door they'd come in by. "I'd think you'd have enough problems with the animals you've already got." The albino circled around to Rahel's other elbow, just in case she entertained some silly plan to resist.

She didn't. "Well, we're funny that way." Rahel fell into step between them without bothering to put Toad on the floor. "People selling genotypes that we own all the legal rights to has a tendency to tick us off."

"Moral superiority has a tendency to tick me off." Nadder levered open the cargo door and ushered Rahel through. "You guys think your kind of purist conservation shit is the only right way to keep four-legs. Even if I *was* selling your genomes—" She slammed the door behind them. "—which I'm not—what makes it so wrong to give people a taste of what they can't get anywhere else?"

"Don't try to tell me you're not selling Terran genotypes." Rahel opted to stay with the strictly legal end of their discussion—the black-marketeer's profession made the larger ethical question seem hardly worth pursuing. "You think I don't know authentic gross structures when I see them?"

Nadder shrugged. "I'm glad you think so. But it's not like you actually looked at any *animals* today."

Rahel stopped just inside the final hatchway, bumping her elbow back against the albino when he would have shoved her forward to keep her

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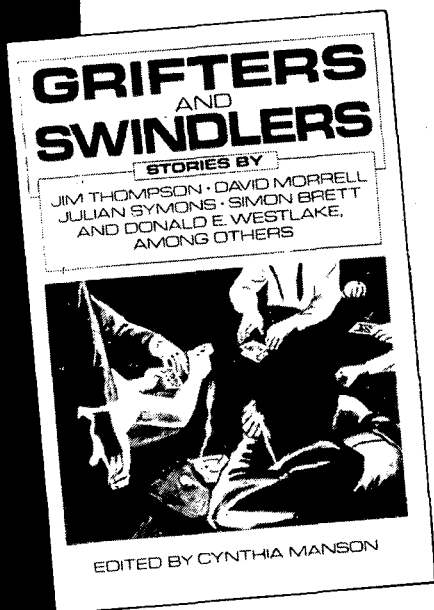
Edited by Cynthia Manson



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moving. "What are you talking about? I saw the partulid and—"

"You saw a partulid *simulacrum,*" Nadder corrected her. The marketeer's smile was as slick and artificial as her hair when she took Rahel's arm and accompanied her the last few steps onto the dock. "That's what I sell, after all—VR tours of an extinct zoo. If you came here thinking otherwise, proctor, I'm afraid you were misinformed."

Noah's Ark had spent nine months and a small jumpship's worth of money tracing leads and rumors beyond the edge of human space to the Newborns's Interface. What had started as a search for the origins of a single bootleg Terran cargo had grown into one of the Ark's primary projects. It was the strength of that history and her own long hours of clue-sniffing and travel that let Rahel scowl down into Nadder's face and say with such grim certainty, "Bullshit."

The marketeer's smile stretched even more irritatingly serene. "I guess you'll have to prove that." She slapped the control that closed *Medve*'s airlock door.

"Wait a minute!" Dancing forward, Rahel caught the edge of the door with her palm to halt it in its track. "Aren't you at least going to tell me how you found out where I was from?"

Nadder tipped her head as though considering, then smiled in what looked like honest amusement when Toad echoed the gesture with one brindled ear cocked higher than the other. Behind her shoulder, the albino actually laughed.

"Staffordshire bull terrier," Nadder said suddenly. She wiggled her fingers at Toad, then turned her eyes more directly on Rahel while the puppy fidgeted delightedly at the attention. "Holds the domestic record for going from endangered to extinct in less than ten years back in the early twenty-first—one of many victims of the pre-Reform urban paranoia. I've never heard of anybody offering that kind of blueprint for open sale." She hooked a thumb back toward the albino. "Took Styen nearly fifteen minutes just to match a visual to our records. That left only one place that little dog could've come from."

Rahel nodded, already blushing with self-anger at her own shortsightedness. "Noah's Ark."

Smiling, Nadder tapped the end of her downturned nose and poked at the door controls again. Rahel stepped grudgingly back to let the airlock hatch slide closed. Nine months and uncounted millions of credits, just so Rahel could put them right back where they'd started less than two hours after setting foot on the station.

She kicked at the now impassable airlock door. "Dammit."

"I can't believe I blew it!"

"Does that mean it's too late for me to suggest you leave the dog behind next time you go onstation?"

Rahel aimed a withering glare at the comlink over her shoulder, and Paval's image on-screen returned her scowl with eyebrows raised in his traditional expression of innocent

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query. She still hadn't decided how much of her apprentice's little-boy sincerity was for real, and how much he affected just for the sake of annoying her.

"Your next lesson when I get home will be all about giving advice *before* it's needed, not after." She pitched Toad's ball over the puppy's head, sending both ball and dog bouncing madly down the jumpship's center aisle.

"Well, then here's some advice for your next course of action: See what you can find out about Nadder around the rest of the station. Who knows what we'll find useful next time—"

"There's not going to *be* a next time." Rahel sighed in frustration as Toad cavorted back to shove the warm, spit-slimed ball into her palm. "By the end of tonight, Nadder's going to have memorized the face, name, and description of every proctor in Noah's Ark." She threw the ball again, wiping her hand on the leg of her pants. "Face it, Junior—we're screwed."

"We're not screwed." Ah, the certainty of youth. If she hadn't been so angry with herself, Rahel might have laughed at his grim earnestness. "Nadder won't bother arming herself against us, Proctor Tovin. It's not like we're some sort of legal authority—we're a private corporation that's taken on an investigative task because nobody else cares about it. Even if you'd gotten past the contact today, we would still have had to prove wrong doing on Nadder's part before the legal net would make a move."

But now they couldn't even do that. "She's never going to let an Ark proctor on the same station with her again." Rahel tugged the ball from between Toad's teeth and slung it down the aisle somewhat harder than before.

"Then we'll just send somebody else."

The apprentice's words poked her like an electric shock. Ignoring Toad's happy snarlings when the dog returned with her fresh-killed ball, Rahel swung to face the comlink and Paval's startled blink. "What did you say?"

He shrugged uncertainly, as though not trusting whatever verbal trap he'd unwittingly stumbled into. "Noah's Ark has money. Surely we can hire someone not affiliated with the Ark to go in and make the purchase for us. Once we've got the merchandise and the manifest, we can press the cops to at least open up an investigation." He brought one hand up to touch the edge of his screen when she jumped to her feet and Toad began barking with excitement. "This is a setback, Proctor Tovin, not the end of the world."

Not even much of a setback, if she made good use of her options. She kicked Toad's ball farther down the aisle, then snatched up a blue-and-green print jacket to shrug on over her khaki Noah's Ark bush shirt. "I should have thought of this from the beginning!"

"Proctor Tovin?" Paval's voice echoed slightly in the empty cockpit behind her. "You're off visual. Are you going somewhere?"

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She jumped back up the stairs to lean over the comlink and smile down into his anxious face. "Junior, I'm going out to buy some Terran animals." She chuckled wickedly before punching off the channel. "I'll give you a call when the setback's over."

"I want something Terran," she told them. "Something *big* and Terran. Price isn't an object, and size isn't a problem. Just get me something living, and *make sure* it's authentic."

That was part of the brilliance of her plan. By sending her agents off with such a specific—yet broad—requisition, Rahel could almost certify they'd return with one of the high-demand "glamour animals"—a lion, or an orca, or maybe even a gorilla. Something of the romantic, frightening nature that appealed to people who fancied they could "own" animals, rather than just live with them. Nadder was certain to have a wide selection of such genomes available. Rahel, meanwhile, would be able to tell with a look if what she'd purchased was Terran without having to wade through the snails and toads and spiders who weren't in her area of expertise.

"Arrange for payment through whatever third party makes you happy—I don't want Noah's Ark's name showing up anywhere. And no matter what else happens, no matter who asks, don't say anything to anyone about the details of this transaction. This has to be completely private. Do you understand?"

They'd just stared at her in unreadable silence, then turned and ghosted off toward center station in a cloud of brilliant ringing.

She'd expected them back within the hour.

Instead, morning crept into afternoon, she turned down two 'link calls from Noah's Ark, and Toad went to the bathroom in the airlock. After that, Rahel took the puppy outside to chase her ball up and down among the maintenance sleds, then sat under the jumpship's landing gear until Toad found gnawing on her ball too much effort to maintain. Groaning with contentment, the puppy fell asleep with her head hanging over Rahel's knee and her tongue peeking out between her teeth.

Rahel followed Toad into sleep less than three hours later. Sitting up in her bunk with half-read downloads strewn across her lap and Toad draped over her ankles, she noticed when a simple figure reference made absolutely no sense to her conscious mind. So she sighed, closed her eyes, and tipped her head back against the bulkhead for just a moment's respite.

Something jerked her back into wakefulness what seemed like only an instant later. "What?" She bolted upright in the bed, scattering downloads everywhere. "What is it?" Toad stretched with a grumble, but didn't awaken.

"There are seven beings requesting entry at the main airlock," the ship informed her. Rahel liked this jumpship's voice—helpfully female without being obsequious. "Shall I admit them, or do you wish to escort them manually?"

Seven? Good God, please don't let

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them have bought her an elephant! She squirmed hurriedly out from under Toad and the rest of the downloads. "Do they have any cargo with them?"

"They have a livestock shipping crate. I cannot see inside it."

Good enough—and better than she thought she'd get after leaving Nadder's berth this morning. Padding stocking-footed through the ship's empty corridor, Rahel called up the lights as she went. She skidded to a stop at the airlock and slid aside first one, then the other hatch to face the small crowd and their shiny, steel-sided shipping crate.

One of the duacs sneezed and leaned over to lick its neighbor's ear.

For some reason, when the ship reported seven beings waiting outside her jumpship airlock, Rahel hadn't expected four of them to be duacs. And she'd rather hoped at least one of them would be *dhaktu.* Glancing between the three mazhet ringing the crate, she raised eyebrows to the puce and violet figure she assumed to be Ayr. The mazhet looked back at her with emotionless patience.

"You got the Terran animal I commissioned?" Rahel nodded toward the crate without taking her eyes off the aliens. The crate didn't seem as large as she'd hoped for—only about three meters deep, and not even as tall as her shoulder.

Ayr dipped its chin to touch its chest once, quite deliberately.

"And I don't suppose any of you has a *dhaktu* up his sleeve?"

This time they all only stared at her, and Rahel had to scrub at her eyes to keep from laughing with weary frustration. "No, of course not. All right. . . ." She stepped aside and waved them through the airlock. "Bring it in here."

The green and aqua mazhet on the left flicked one spidery hand across the top of the crate, then Ayr and the mazhet in yellow, salmon, and pink applied gentle pressure along both sides to glide the metal box forward. Rahel couldn't see that it rose above the decking, but it slid forward as easily as hot oil on ice, even clearing the hatchway without appearing to lift up over the edge. The duacs stirred themselves in no discernible order and followed the mazhet inside.

Toad sat blearily in the middle of the main compartment, watching Rahel and the mazhet maneuver the crate through the open hatchway. Even when the duacs clustered around to nudge at her with their blunt noses, all Toad did was lean against the nearest one and sigh sleepily. The duac twitched one ear flat to its skull and glared at the puppy. Its three companions sank to their haunches a respectful distance away.

"I want to have a look at this thing before we finalize our transaction." Rahel trotted away from the mazhet long enough to retrieve the snooze pistol she'd left lying on the flight panel. "It's not that I don't trust you—it's Nadder I expect to play some tricks. Now, if you'll let me—"

Ayr stepped in front of her before she could approach the box. It closed long, dry fingers around her wrist, pushing the snooze pistol off to one side as it clicked and ticked and rat-

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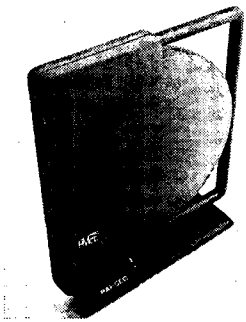

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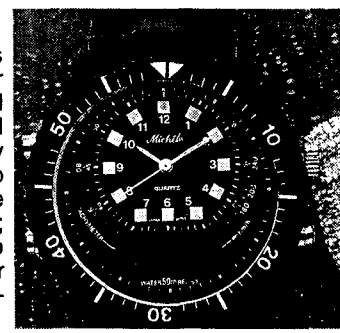

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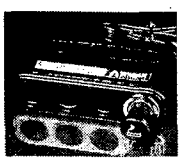

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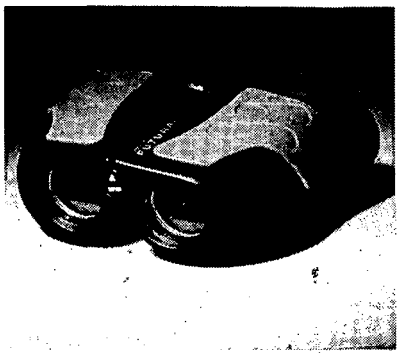

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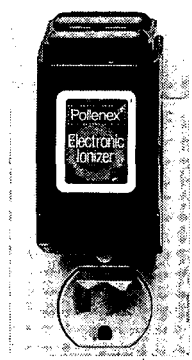

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tled in the longest run of untranslated mazhet Rahel had ever heard. She shook her head slowly, not sure if she should be watching the mazhet's face or the quick, elaborate hand gestures it rang and sparkled in front of her.

"I'm not going to hurt it." She tried to bring the pistol up between them again, wanting to explain how gentle and harmless it was. Ayr only pushed the weapon persistently aside. "This gun will only put it to sleep for a little while—just long enough for me to run a few tests, that's all."

Ayr patted her chest, hands fluttering like bird's wings, then pressed a corpse-cool palm to her forehead.

"I don't understand what you want from me." Rahel ducked a look at the mazhet still waiting by the unopened crate. "Do you have a *dhaktu* you could send for? Anyone you could bring?"

They might have been deaf for all the reaction they gave her. Ayr pushed at her forehead again, touched her chest, and Rahel caught its hands between hers to keep the mazhet from flustering through the senseless pattern again. Its hands felt as though she could shatter them with a single intemperate squeeze.

"Just let me have a look at it." She locked her eyes with the mazhet's fathomless black ones, not at all sure if that gesture was socially correct. "I won't hurt it, I won't let it out. But I need to see what you've brought me before we can go any further." The gentlest of pressure backed Ayr into its former position alongside the others. "You know, you could have brought one of your 'invisible voices,' and we wouldn't be having this problem."

The mazhet all rustled with the same ringing of bangles, but they said nothing to her or each other.

Rahel repositioned herself in front of the crate, and checked the charge on her snooze pistol. More than enough to lay low anything that could fit inside a container this size. "OK, then. . . ." She nodded tightly to the green and aqua mazhet. "Open her up."

A chime and brush of movement, and the mouth of the crate hissed open. Rahel crouched, steeling herself for an explosion of movement, a scream of animal anger, a howl of animal pain. Instead, still silence puffed out on the stench of sweat and feces, and the tiny, rapid sound of breathing echoed through the empty crate like thunder. Frowning, she knelt very slowly.

"Oh, good God. . . ." She thumped down onto her bottom without meaning to, and the snooze pistol fell, unfired, across her lap. Hand tangled halfway through her sleep-tousled hair, she stared into the long, darkened crate without the ability to marshal enough thought to disbelieve.

From the back of the crate, the brown, frightened eyes of a very human boy stared back at her in silence.

"It's all right, nobody's gonna hurt you. . . . Do you have a name? Do you know what I'm saying?"

No, of course he didn't. Rahel could tell by his eyes—those quick, intelligent eyes that followed her every gesture, her every shift in weight

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with the desperate intensity of a wild animal. She'd seen Toad look at her with more understanding whenever she said the words "out" or "play" or "good dog." All this boy's reactions proved was that he wasn't deaf—and that he was nearly mindless with fright.

"You poor thing. . . . " Rahel eased into the mouth of the crate and sat back on her heels. "I wish I knew where the hell she got you." The boy only stared at her and hugged his knees ever tighter to his chest.

Naked and unwashed, he wasn't recognizably from any particular culture, and his small, caucasian features placed him squarely in the least remarkable phenotype. Even his filthy hair and build proved little help in guessing his origins; Rahel thought the matted snarl might be yellow (but wouldn't put money on it until she had him washed), and his 150 centimeter height could be indicative of either a normal child or a smallish adult. His face and chest were hairless. The muscles of his legs and shoulders, though, were those of a post-pubescent who'd reached the wiry spareness of maturity. Yet he'd defecated in the opposite corner of his crate, which was something even a dog wouldn't do. The debate over Nature vs. Nurture sat staring at her from the end of a mazhet-built shipping crate, and it looked like Nature was winning.

She leaned back into the open and met Ayr's eyes across the top of the box. "Has anyone got the control for the collar?" From a crate-length away she could see how the boy's collarbones were bruised and raw from the restraining band Nadder had bolted around his neck. She wondered how many times the black-marketeer had found it necessary to sting the boy with the restrainer's neural pulse, and how many times she had jolted him completely unconscious. Getting rid of the damnable "training device" moved up to Rahel's first priority.

"The collar," she said again, a little louder and more slowly as she traced an arc on the front of her neck with one finger. "Did Nadder give you the control for the restraining collar?"

The mazhet stood as though unhearing. Rahel groaned and turned away from them with an angry wave. "Why do I bother to ask you anything?" It hadn't occurred to her she'd need to insist the mazhet retrieve all the hardware associated with Nadder's merchandise. But, then, it hadn't occurred to her the merchandise would be human, either.

A melodic chime fell from the AI's shipboard speakers. "There are two beings requesting entry at the main airlock," the ship informed her.

Rahel craned a hopeful look toward the ceiling. "Is either of them human, by any chance?"

"One of them is human."

"Hallelujah." She shimmied the rest of the way out of the crate, then stood and placed her body in front of the exit with both hands on either corner of the roof to feel for any movement from inside. "Let them in."

The *dhaktu* scurried through before the airlock door even finished

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sliding open. True to his job description, he slipped among the mazhet in timid silence, not sparing Rahel so much as a smile. Maybe he was afraid she'd humiliate him by offering a greeting. Rahel made an effort to contain herself. It wasn't until Toad scrabbled to her feet with a scream of distress that it occurred to Rahel to look and see who followed the *dhaktu* inside.

The Larry tlict cringed away from Toad's frantic barking, upper appendages flaring wide in what had to be a threatening display, medial appendages pulling close to cover its eyes. Remembering the barely controlled violence of the first tlict she had seen, Rahel dove to grab the puppy out of this one's way. Toad's only movement was to back away from the tlict in panicked hops every time she bayed. She wheeled with a startled shriek when Rahel's hand closed on her collar, then hunched into a crouch and squirmed up into Rahel's arms. From that position of safety, she took up her barking again while Rahel trotted down the corridor to lock her in the bedroom. She'd never felt the little dog tremble so violently.

By the time Rahel made it back to the central compartment, the tlict had crabbed its way halfway around the room so as not to lose sight of the dog. "Private abode. Restrictions. Restrained. Yes? Yes?" The translator pressed against the tlict's abdomen muttered and hummed with untranslatable pheromones.

Rahel ducked a peek into the unattended shipping crate. Eyes bright like polished walnuts glinted back at her through the darkness. At least they hadn't lost the boy.

"This ship is my private property," she told the tlict, turning back to face it. Limbs wove between each other to pass the translator up to the alien's tiny mouth. "My animal has the right to run free in here, and the Newborns promised me this."

"Yes. Yes."

"She'll stay in another part of my ship now, so that she won't bother you or the others."

"Yes. Yes. Good air. Good breathing."

Whatever the hell that meant. "Now will somebody please tell me why I have this Larry on my ship?"

Ayr drew her attention with a gentle ringing of golden chain. "The merchandise did not appear in a healthy state." The *dhaktu* stood as still and servile as ever behind the row of mazhet, but Rahel had never heard an invisible voice sound sweeter. "It was determined a physical caretaker should be consulted as to its viability."

Rahel nodded, then realized what exactly they'd just told her. "A *doctor?*" She jerked a startled look at the Larry. It stroked its eyes in nervous repetition. "The tlict have a *doctor* who can treat human beings?"

"Tlict. Not-tlict." It shifted uneasily onto its hindmost limbs. "Medicine treatment of not-tlict."

She shook her head in slow confusion. "I don't understand."

"This tlict is a veterinarian," the *dhaktu* volunteered without benefit of a mazhet's initiative.

A veterinarian? When its species ap-

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parently had no tolerance of animals, and very likely had none as pets? "I suppose that's appropriate, at least." She retreated an uncertain step, not sure if she should drive the tlict out or thank it for coming. Finally, she settled for sinking to her knees at the mouth of the crate and sighing at the boy still huddled at its rear. "Let me see if I can get him out for you." She went down on all fours, slipping the fallen snooze pistol into her pocket as an afterthought.

The floor of the crate felt clammy and damp beneath her hands. Sour with human sweat, humid from urine and the boy's labored breathing, the air in the crate nearly gagged her. She bit down hard against a cough, then stopped half-way down the box's length to sink back on her heels and make eye contact with the boy. He crushed himself deeper into the corner he'd claimed as his own.

Rahel's stomach tightened with regret. "I'm not gonna hurt you," she whispered, just like she'd murmured to all the coyotes she'd tagged and sampled back home. "I know you're scared, but it's OK, everything's gonna be OK."

Just like the coyotes, his eyes reflected back a ghostly red that showed no signs of understanding.

"But you're not a coyote, are you? You're a boy. Which means there's something besides instinct going on in that oversized skull of yours." Deliberately keeping her voice gentle and soothing, her face serene despite her words, Rahel eased forward on hands-and-knees. The boy's eyes flicked to follow her movements. "You know I'm a human, too. You know from the way I'm talking and moving that I'm not coming in here to rough you around, don't you? We're just gonna get a look at you and make sure everything's OK." She placed one hand feather-light against the side of his leg. His skin twitched away from her touch like a horse's skin away from a fly.

She didn't pull her hand back. "There's no place else for you go to," she said, sliding up his leg to where his arms were locked around his updrawn knees. "You're just gonna have to come out here with me." And she closed her fingers around his wrist with a carefully calculated amalgam of tenderness and strength.

The boy exploded with a howl of rage. Rahel found herself jerked violently forward while he twisted and kicked and clawed to be rid of her. One wall of the crate banged into her shoulder; the boy's back shoved awkwardly against her armpit as he planted bare feet on the opposite wall and clenched every muscle in his scrawny little frame to break away.

"Oh, no, you don't!" Still gripping fiercely to his wrist, Rahel snaked her free arm across the boy's chest to wedge him against her and break his leverage. He gave in to her pulling immediately, and they crashed sideways onto the bottom of the crate. Rahel was willing to count that as a preliminary victory right up to the moment he wrenched his captive hand up in front of his face and bit into her forearm with a gristly crunch.

"Ah, goddammit!" Anger took the short route straight into her blood-

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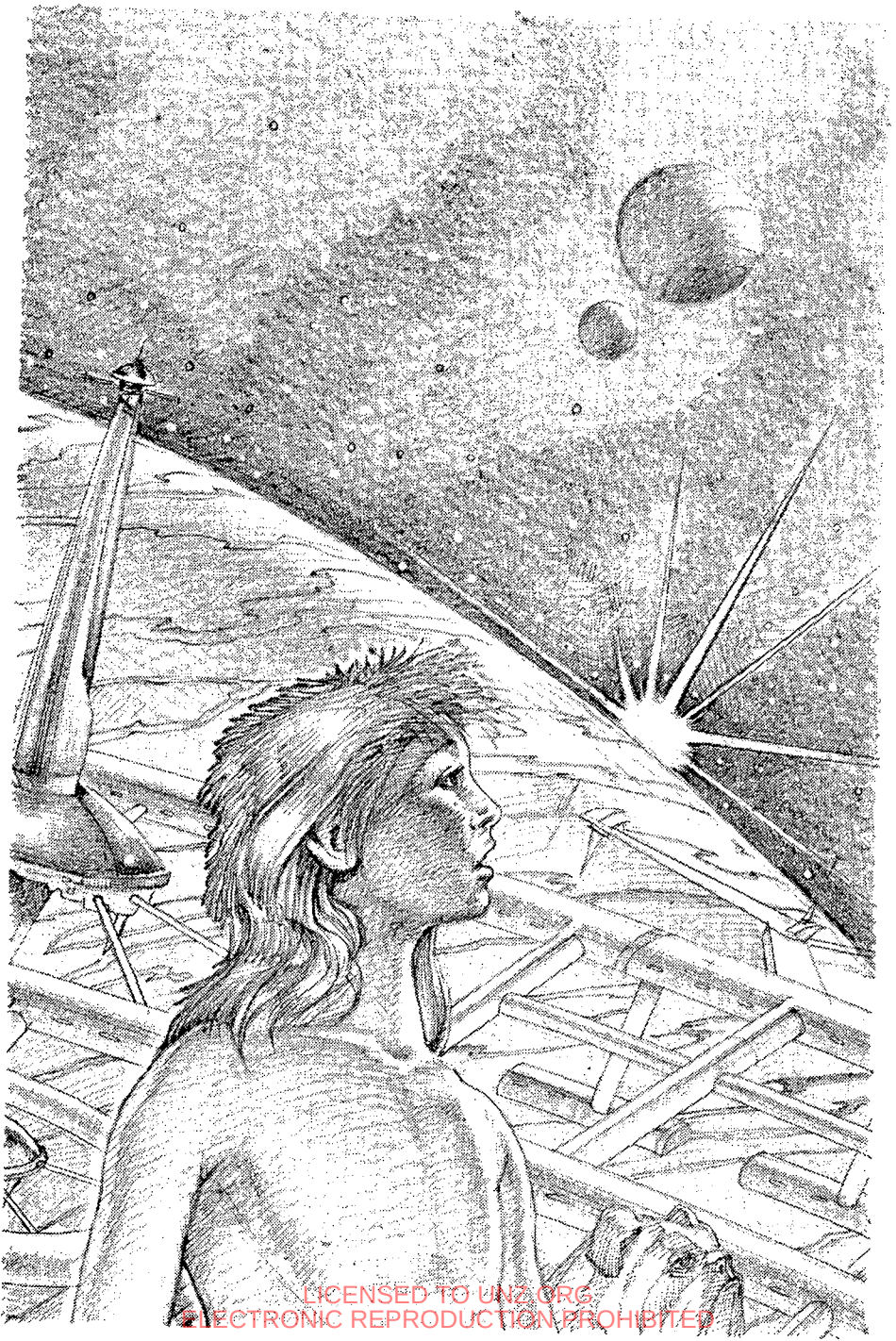

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stream. She swung one leg over the boy and pinned him in retaliation. "You little—!"

"Proctor Tovin?"

He squirmed frantically beneath her, jabbing his elbow at her thigh, and bit down harder when she tried to use her free hand to grab his flailing arm. She shouted again in pain, and suddenly understood what it felt like to want to beat another human being senseless with your bare hands. Jamming her forearm more firmly into the little beast's mouth, she rolled onto one hip and dug across her front for the snooze pistol in her opposite pocket. It jutted against the fabric of her trousers like some dissatisfied animal who wanted to escape.

"Proctor Tovin?" the *dhaktu* called again. "Is some assistance required?"

Surely some mazhet had initiated the request, but Rahel would be damned if she could guess which one. "No!" She squeezed the pistol's trigger without bothering to work it free of her pocket. The boy jerked with a yelp, then collapsed into a loose sprawl beside her. If anything, the pain in her arm redoubled with a throb when the boy's bite pressure lifted.

"Doings between you sound most violent," the *dhaktu* pointed out in sync with someone's rapid clicking. "The mazhet remain available to assist in the unpacking of this merchandise."

"All right, then." Trying to ignore the progressively sticky feel of her shirt sleeve, Rahel untangled herself from the boy and rolled him over. "Get me the medikit from under the pilot's console in the cockpit." He seemed so light and tiny now that she could drag him from the crate without fighting. It was almost like handling a toy.

The yellow and salmon mazhet shadowed her, medikit balanced on one hand, as she backed out of the crate with the boy in tow. "Spread the blanket there." Rahel jerked her chin toward the floor to her left, then waited somewhat impatiently while Ayr helped the first mazhet unfurl the blanket from the lid of the kit. Blood gathered in the elbow of her sleeve, spattering against the floor one fat drop at a time with a brittle *tick, tick, tick.* Behind her, the tlict echoed the sound with its toenails in apparently unconscious mimicry.

The mazhet laid out the blanket at an angle to her, one corner near her ankle, the opposing corner aiming across the deck toward the cockpit door. She lowered the boy onto the square without commenting on its odd positioning. Tugging her sleeve into a lumpy wad near her elbow, she backed away from both mazhet and boy to give the tlict whatever room it thought necessary. "Get to work, Larry. He's not gonna be snoozed-out forever."

The tlict scrubbed fretful arms across its eyes, then scuttled forward to straddle the boy's body and probe him with some abdominal appendage. Rahel hoped to hell the kid didn't wake up to that view.

She accepted the sterile wipe yellow-and-salmon handed her, then hissed through her teeth half in pain, half in dread as she daubed away the

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blood obscuring the wound. More welled up to replace it, but not before she could see the ragged half-moons of actual damage. He may not have had well developed canines, but the little bastard had certainly got her good.

Yellow-and-salmon pressed another clean wipe into her hand, and Rahel cocked a glance at the alien as she took it. The mazhet had turned the rest of the medikit to face her, obviously expecting her to select whatever medicaments she needed from the array in the bottom of the box. Rahel plucked out a largish handful of dry gauze to pack against the wound.

"Now that I've got your undivided attention. . . . " She aimed the comment at the other two mazhet as much as the one by her side. "Can one of you tell me who's got the control for the merchandise's restraining collar?"

Yellow-and-salmon's huge black eyes studied the treatment of her wound without blinking. Ayr and its companion only stood complacently, as though she'd never spoken.

Rahel wasn't surprised to discover she was in no mood for mazhet weirdness. "What?" She looked irritably among the three of them. "Is there some mazhet rule against answering simple questions?"

The boy's rapid breathing and the creaking of tlict limbs were the only sounds in the central compartment. The duacs had wandered off to sniff at Toad's door and annoy her.

"The rules of the barter." The *dhaktu* said it suddenly, without any mazhet's urging and as though he surprised himself with the sound of his own voice.

Rahel aimed a frown at him. "What barter? Ours?"

The *dhaktu* dipped a stilted nod, wringing his hands in the folds of his orange robe and speaking in a quick, breathless voice completely unlike the competent tones he used as a translator. "They're bound by the conditions of your agreement, proctor. You instructed them never to speak of the transaction with anyone."

She dropped her arm to her side in shock, and was rewarded with a thick pulse of pain. "I didn't mean me!"

The *dhaktu* winced a shrug. "You said anyone."

The concept of banging her head against a bulkhead suddenly seemed very appealing.

"Healthy scenting. Tasting strong."

The tlict stepped over and away from the boy with the delicacy of a four-legged dancer. Rahel brought her arm back up to her chest with a sigh, just as glad to turn her attention on the Larry and away from her own stupid barter technique.

"Yes. Yes," the Larry's translator stated solemnly. Its smallest arms danced here and there across its thorax as though searching nonexistent pockets for something. "Small food. Dark air. Non-tlict merchandise. Large food. Wise air."

Rahel nodded slowly. "The boy needs food and a better environment." She was guessing at the tlict's full meaning, and wondered if repeating what she thought it meant

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would just get her words translated back into the same near-nonsense the tlict had said before.

Whatever happened when her voice crossed the language barrier, the tlict's tiny mouth parts played across its translator and it waved its lower arms enthusiastically. "Large Food. Wise air. Yes. Yes."

Well, at least that kind of help wouldn't be too hard to administer. Just about anything would be better than wherever this poor kid had already been. "Thank you." She touched her fists to her mouth the way she'd seen Ayr do with the first tlict this morning, hoping it was remotely appropriate to the situation. "Is there something I owe you for doing me this service?"

"Worry. Answer." The tlict bobbed twice on its multijointed legs. "Answer. Worry."

Rahel took another blind stab at the alien's meaning. "I'll answer your question if I can."

"Not-tlict you. Not-tlict this." It tickled at the boy's midsection with one hind leg. "Difference. Yes? Difference. No?"

This was perhaps the clearest thought she'd heard come out of a tlict so far. "Difference no. The merchandise is a human being, just like me." She angled a look at the prone figure beyond the tlict, and frowned beneath an unexpected stab of pity. "He's just had a harder time than most of us up to now." How to explain feral children to an alien? And was it even worth really trying?

Hard-bladed toes clattered on the decking as the tlict sidled toward the airlock door, chewing on its translator. "Worry. Worry. Larry touches. Gertrude breathes." It poked a hind foot at the airlock controls without turning to see what it was doing. Or maybe it had spatial sensors beyond the obvious eyes. When the hatch slid open, the tlict scampered inside, still facing Rahel and the boy. "Good breathing. Wise air." It opened the outside hatch the same way as before, then tumbled out into the docking bay at what for a tlict must have been a dead run. "Worry. Worry. Goodbye."

Rahel brought her arm down to peek under the now-darkened gauze pad as the hatch hissed shut behind the larry. "Are tlict always this arbitrary?" she asked the mazhet.

Ayr's skirts rang in what might have been a mazhet shrug. "Tlict are tlict."

Both a definition and the question, but no doubt the best any of them could expect. Rahel sighed and went back to her first aid.

"Well, I'd say your delivery of this merchandise is accomplished." Satisfied that the bite still oozed somewhat prodigiously, she slapped a clean wad of padding over the wound and raised her arm to chest-height again. "You can get the agreed upon fee from Noah's Ark—they're good for it. Just tell Saiah Innis that I—"

The *dhaktu* interrupted her with a delicate clearing of his throat.

Rahel glanced up at the three quiet mazhet, thought about what she'd just said, and smiled thinly. "Oh, yeah. Forgot about that. Here. . . ." She trotted into the cockpit to fetch her notebook off the console. Keep-

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ing her left hand clamped firmly over her forearm, she scribbled, *"Saiah—it's a boy! Attached is quote of fee promised mazhet. Pay, but don't ask questions. Will explain once I'm off-station."* She didn't bother signing it. He'd know who it was from.

She popped the data chip and carried it back down to the mazhet. "Transmit this to the address at the front of the message." Ayr tipped its head in acknowledgment when she passed across the chip. "The funds ought to show up in your accounts within twenty-four hours of the Ark receiving the transmission."

All three mazhet swarmed into a knot to slip the chip from hand to hand. It finally vanished into the event horizon of green-and-aqua's robes, and one of them announced with a clatter, "This is equitable." They swept into the airlock in a single cloud of silks and bells and ribbons. The four errant duacs jogged after them a moment later, as though only just realizing their masters were leaving. From far off down the hall, Rahel heard Toad wail with grief at the loss of her alien playmates.

"I guess that means there's just you and me."

Small and fragile in his unnatural sleep, the boy curled up with a whimper and covered his face with his hands.

She didn't really want to, but she snoozed him again before the first shot had a chance to wear off. A boy wasn't like other animals, she reasoned. He had wants and imagination, not just thoughtless genetic imperatives—he would know her handling of him was indelicate, would recognize himself as powerless, would never forget the details of what she did to him, just as he would never understand the whys. Better to take care of as much as possible with his fears and emotions safely tucked away in slumber. Maybe then he'd view the indignities she wrought as mysterious acts of providence, and not specifically something Rahel had done.

Before touching him, though, she finished cleaning and sealing her bitten arm, adding a broad-base antibiotic and a rabies booster just to say she'd thought of everything. Then she ran to the lab and gathered enough tools, handling equipment, and sampling gear for everything she could possibly want to do. On the way back, she stopped by her quarters long enough to quick-step around Toad and dig a T-shirt out of her clothes locker. Once she'd filled a shallow laboratory bucket with water and rags, she headed back for the main compartment with Toad prancing behind her with a mouthful of extra towels.

Toad's contributions to the proceedings only slowed things down a little. "Get away from there." Rahel elbowed the puppy back from the boy's face when Toad abandoned the towels so she could explore him. Complaining, Toad circled Rahel to find a less obstructed position, then resumed her cheerful licking. "He doesn't want your kisses. Now get over here." Rahel, however, hadn't yet enjoyed much success convincing

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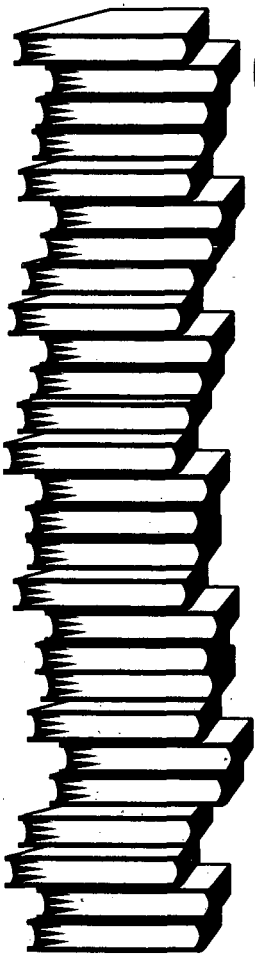

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Toad that normal, conscious people didn't exist just to be her undying friends. She didn't sustain much hope of having any better luck with a snoozed-out feral boy.

Rahel didn't know what sort of tools people used to fasten on a restraining collar, but a pair of industrial-strength power clippers sheared off the device with no particular effort. She slipped the hateful thing from underneath his neck, then tossed it into the bottom of the crate where it wouldn't be in their way. He would probably still be looking at scars on his neck and shoulders from Nadder's bondage. It was too soon yet to tell.

She took a blood sample from a vein in his neck, a tissue scraping from the sores left by the restraining collar, and a membrane swab from his sinuses. Bad enough that she had to knock him out instead of taking the time to win his trust—at least she could hide whatever discomfort the scrapings caused among the damage inflicted by Nadder. It didn't make much difference how much he ended up hating the black-marketeer. Rahel, on the other hand, still had to get home with the boy.

Running back to the jumpship's lab with her samples divided between both hands, she slapped together a quick set of slides and fed them into the testing station. "Check the blood and mucal smears for antibodies, antigens, parasite residue, and possible infectious agents. I'll need a vaccination set for him, plus medication for any diseases or parasites you find in his system."

"Species of sample donor?" the AI asked.

"Homo sapiens." She snapped closed the last set of slides and sent them after the others. "These are dermal and subdermal tissue samples from the same specimen. Get me a DNA spin and cross-match against the entire Noah's Ark database. I want to know what breeding population his genetics are from, and an estimate on his age, if you can give me one. Log all of this under Feral Aral, Interface Acquisition #1."

"OK." The AI shuffled the slides into queue somewhere deep in its works. "Blood and mucal analysis complete. Results dispatched to screen two. I can display the requested genetic results in approximately ten hours sixteen minutes."

"Sounds good." It wasn't like she wouldn't still have the boy tomorrow. "Let me know as soon as you've got them."

Scientific curiosity taken care of for the time, she assembled the vaccination set recommended by the AI and took it out to the boy. Toad had already flopped to the floor full length in order to groom between his toes. Pausing to ruffle the puppy's ears—"Thanks for the help,"—Rahel administered the injection, squirted parasite medication between the boy's teeth, then pulled the bucket over to start on the unpleasant task still before her.

If this boy had ever been bathed, it was so long ago as to not count anymore. Water ran off his chest in scattered beads, repelled by the oil and filth before it could even dampen his skin. Rahel swallowed her disgust

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and soaped the rag into a dripping, frothy cream between both hands. Draping the cloth across the boy's arm for a moment produced somewhat better results: a patch of stained, pinkish skin appeared in response to her gentle scrubbing, and a smelly crust of dead cells and rancid sweat came off on the rag and turned it blackish. She dunked it into the bucket to rinse out the worst of the grime, then attacked the soap again before slathering rag and water all over the rest of his arm.

Little by little, the details of his previous life exposed themselves—like brush strokes on an ancient painting, previously hidden behind a lifetime of neglect. Scars like fine, white lacework on his hands, his knees, the fronts of both narrow shins. Palms as rough and hard as dried leather, feet even harder and thicker than that, and not as much as an intact nail among them. Worn but sturdy teeth with no sign of breakage, misalignment, or dental caries. Long, startlingly dark eyelashes. Eyebrows the same tarnished gold as ginger honey, and fine, brittle hair that would probably be the same color once it grew back without the filth and tangles. She had to tell herself over and over again that even a bad haircut didn't last forever before she could bring herself to shave his skull down to a pale fuzz.

Once she'd bathed him, dried him, and swabbed him head to toe with a topical insecticide, she cleaned and dressed the wounds around his neck and wrestled him into the overlarge T-shirt. The teal-and-white shift hung down around his knees. Combined with his new haircut, it made him look like an underage krishna monk with no fashion sense.

"Well, Spud, what do we do now?"

Toad looked up from mauling the power clippers, just in case the comment meant she was about to be played with or fed.

Rahel leaned over to relieve her of the shears, exchanging them for the closest legitimate chew toy at hand. "The way I see it," she said, bouncing the toy against Toad's nose until the puppy snapped and snorted with joy, "I've got two choices—lock him up in the shipping crate again, or give him free run of the jumpship." She finally let Toad wrench the toy from her hand and proudly trot a few meters away. "Both of which options suck."

In her heart, Rahel never liked putting animals in crates, even when she knew in her head why she had to do it. But her cargo now was a human, not a basilisk, or an oryx, or even a high-functioning bonobo—and for all their biologic composition, humans just weren't like other animals. Assuming that spending every leg of a seven-gate trip in almost total isolation didn't irreparably damage his psyche, he was still sure to suffer from whatever distorted visions his imagination fed him about what waited at the end of his confinement. Most animals had a better time of it if you left them in the dark and quiet, not stressing them with your presence. Human animals, however, could supply plenty of stress just with their own thinking if there wasn't

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enough input to keep their overevolved brains occupied.

Which brought them to running around the ship at will. Suddenly, the boy's kinship with the rest of Terra's fauna seemed a lot closer than it had moments before. He may or may not be housebroken; Rahel had a four-month-old-puppy, so bathroom habits were the least of her worries. Jumpships contained a great deal of equipment, though. There were places he shouldn't get into, buttons he shouldn't push, compounds and instruments he shouldn't touch. If he'd been a chinchilla, she wouldn't have cared where he scampered. But this animal was a human—worse yet, a human boy. There wasn't a door on this ship he couldn't learn how to open, not a button or panel or storage bin he wouldn't be able to reach. If she let him run loose, he'd very likely kill himself before they made it to the first gate. Where would all her concern for his freedom and comfort have gotten them then?

In the end, she carried him back to the lounge and tethered him to a table. He'd be able to reach every part of the room except the door, and the lounge offered both a carpet for soft walking and a grotesquely colored couch. She tossed all the extra blankets and pillows into the room at random. Maybe he'd want to make a bedding pile for himself. Maybe he'd want to hide behind the sofa. Giving him such harmless options was the only freedom she could grant.

She fastened the EV tether to the leg of a built-in table, then attached a soft-cuff bracelet to the boy's wrist. Toad supervised with her head under Rahel's armpit. Rahel made sure the cuff was tight enough not to chafe but not so tight as to feel like a punishment. Then she burned off the latch so that nothing short of a surgical laser could get the restraint off again. She didn't know the boy well enough to estimate his intellect, but she'd seen orangutans fiddle their way out of soft-cuffs just like this one. She wasn't taking any chances.

The boy came awake while she was checking the last of the cable connections. Crawling out from under the table, Rahel stood to find the boy squatting at the other end of the room, heels flat to the floor, hands linked in front of his shins. He didn't look up at her, instead fixing his attention on the soft-cuff encircling his wrist. He picked at the edges, followed the curve until reaching the ball joint that connected the tether. Then he closed his hand around his wrist and sat, eyes downcast, face obscenely still.

A splash of wetness darkened the teal stripe in his T-shirt, quickly overlaid by a second drop, then matched by a third. Still, Rahel didn't recognize the uneven splatters for tears until the boy heaved a thin, stuttering sigh and began rocking silently.

She snatched at Toad's collar when the puppy tried to toddle over and investigate. *Leave him alone,* Rahel told herself as she hefted a squirming Toad and soft-footed toward the door. *He's lost everything else—at least you can leave him his privacy.* The boy sobbed with his arms around his knees and his eyes squeezed fiercely

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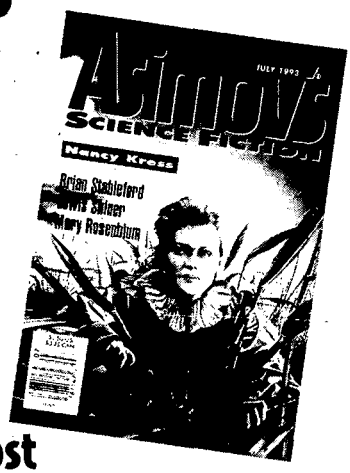

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closed. Maybe he hoped that when he opened them again, he'd be back in whatever world from which he'd been stolen.

Toad's groan of frustration stopped Rahel in the doorway, surprising her more than the puppy's desperate struggles. Toad had never seen a human cry before. Maybe it was that utter strangeness that made her so alarmed at the boy's behavior. "My fault for raising you to be such a good girl," Rahel whispered. She rubbed her nose against the puppy's skull, then let Toad clatter back down to the floor and jitter across the room. The stocky terrier slipped up to the boy with head and tail slung low, ears drooping as she waggled her rear end.

Rahel watched the puppy slide her head under the boy's arm to nose at his chin. Just like dogs, humans had evolved within a pack structure. Status, discipline, and social intercourse were a part of both species' most basic genetic wiring. It was why dogs made such good companions, and why humans so easily passed themselves off as naked, tool using, two-legged dogs.

But maybe the needs of canines and humans overlapped more than Rahel had realized. If Toad had been manhandled and ignored for as many days or weeks as this boy had been locked up on his own, she would have exhausted herself with happiness for anyone who would interact with her, especially if that someone let her run around and chew on things and in general act like a dog. Rahel wondered how long it had been since the boy had been allowed to act like a human, no matter how uncivilized that behavior might be.

Creeping only as far as the end of the sofa, Rahel lowered herself to the floor with her back against the armrest. She listened to Toad groan and whimper, and made sure that a shoulder-width of her back remained visible if the boy cared to look up from his weeping. She wouldn't intrude on his grief by looking at him, but at least she could try to tell him that she was there in case he needed her. That he could retain whatever he recognized as the singularity of himself, but as long as Rahel cared for him, he wasn't completely alone.

When the airlock buzzer jolted her awake some unknown stretch of time later, Rahel at least knew what ship's function had startled the hell out of her this time. She pushed groggily up on one elbow and blinked around the lounge while Toad climbed to her feet and stumbled around the end of the couch in search of a less active sleeping place. "What is it?" Rahel croaked, scrubbing at her eyes and trying to remember why she'd curled up to sleep next to the lounge sofa.

"There are four beings requesting entrance at the main airlock."

She rose up on her knees to look for Toad and found the puppy on the other end of the room, flopped onto her side among a pile of blankets, pillows, and boy. "Can you tell from visual who it is?" she asked the ship, somewhat more quietly.

"Yes. It is Larry."

Rahel jerked a startled glance toward the invisible overhead realm

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from which the ship's voice always came. "Larry?" *Four* of them? In the middle of the night? Or maybe it wasn't the middle of the night anymore. She gripped the arm of the sofa to drag herself stiffly to her feet. "What time is it, anyway?"

"Station time is 1157 hours."

Almost noon. She'd been asleep longer than she thought. "All right, let them in." At least the tlict were unlikely to care about her rumpled clothing and disordered hair. Still, she finger-combed what hair she could away from her face while quietly closing the lounge door behind her.

The staccato chatter of alien feet on metal decking greeted Rahel when she reached the end of the corridor. The four tlict tick-tacked around the main compartment, skirting the fetid shipping crate, stooping to groom each other's belly fur, and randomly scratching themselves with their tiny lower arms as if unable to catch a persistent flea. Walking far enough into the chamber to catch at least one Larry's attention, Rahel clapped a hand over her mouth to hide a jaw-stretching yawn.

"Good morning." Then, remembering the ship's time quote, she amended, "Good afternoon," and tried not to yawn again.

The tlict froze, spiders mesmerized by a pluck on their communal silk. From just inside the airlock, the smallest—a rusty cream-and-brown as opposed to his companion's olive green—caressed its own back with its hindmost legs and juggled a translator into position.

"Good breathing," the translator's passionless voice proclaimed. A background buzz, like distant voices muttering, blurred the otherwise stilted diction. "Wise air. Good breathing."

Rahel nodded. "Right." It was too early in the morning to sort out tlict syntax. "Are you—" She gathered all the aliens up in a single gesture. "Is one of you the Larry I met earlier this morning?"

Two of the other tlict tiptoed over to join the translator, and the ambient mumbling faded. "Larry-this. Not-visit. No. No." A touch from one Larry's upper manipulator arms brought the third tlict over, as well. "Larry-that. Gertrude breathing. Larry-that. Not-current. Larry-this. Not-tlict you retrieve. Yes. Yes."

Rahel pulled back a careful step. "Retrieve?" She wasn't sure she liked the sound of that.

"Yes. Yes." How many of them were supplying the answers, she wondered? How many could hear and understand what she was saying? "Gertrude tastes this," one or more of the Larries insisted. The translator blatted once with static, then cleared again. "Not-tlict you. Breathing strangeness. Answer. Worry. Answer. Strangeness." The tlict all knotted together, lower arms striving to interlink. "Answer. Gertrude."

Gertrude. Rahel scrubbed at her face, suddenly climbing toward full wakefulness as she analyzed the partial sentences collecting around her. "Who's Gertrude? Another Larry?"

Only with an alien could that question come close to making sense.

"No. No." Three bloated abdomens cringed close to the floor. "Not-

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Larry. Gertrude. Not-roaming. Gertrude. Not-simple. Gertrude."

"Gertrude," Rahel said, her stomach chill with understanding, "is a female."

"Not-Larry. Yes. Gertrude. Yes."

A female tlict. The creature the mazhet had said she would never live to see.

"She's not planning to eat me, is she?" Rahel stuffed her hands into her trouser pockets, finding the snooze pistol still pushed into the folds of fabric. She closed her fist around it protectively. "I mean, I don't usually visit people who are planning to eat me."

"Gertrude. Worry. Answer." The translator tlict pushed back between two of the others. "Not-tlict you. Answer. Not-ingest. Answer."

She nodded slowly, but didn't take her hand off the snooze pistol. "In that case, I can probably stop by long enough to talk with her." Would the mazhet pay for details of the first human-tlict coffee klatch? She'd have to ask when she and Gertrude were done. "Just let me get my boy—"

"No!" "No!" "No!" "No!"

The objections cascaded one atop the other, underscored by an orgy of tlict writhing and stomping. As the long silver translator rolled free of the bundle, its metallic voice squealed, "No! Not-tlict merchandise. Not-follow. No. No! Gertrude worry. Not-tlict you. Answer. Worry. Not-tlict merchandise. No!"

"OK! OK!" She beat back an urge to retrieve the translator for them, unwillingly repulsed by the very alienness of their display. "I'll leave the boy here. But you have to bring me back before too long. He can't stay completely alone."

"Yes. Yes. Not-tlict you. Follow." One of the twitching green Larries plucked up the errant translator. It passed between all four of them on its way back to its original holder. "Answer. Worry. Answer. Strangeness. Yes. Yes. Gertrude breathes."

"Let's keep us both that way." As they stepped into the airlock, Rahel wondered if a snooze pistol would even work on a tlict.

With luck, she wouldn't have to find out.

Smells. Wet, frigid, alien smells. Smells that made her mouth taste like ginger, smells that clung like spider silk to her hair. Something hiding in the odors made her heart turn over with grief—but it wasn't a smell Rahel could sense with her nose, just a feeling that swelled up inside her from nowhere as she followed the Larries through the unchanging corridor. In the cold, voiceless darkness of the tlict jumpship, she mistook the melancholy for reality. Then they passed out of whatever area produced the sad aroma, and she felt only confused and manipulated, and more than just a little afraid.

She should never have agreed to come here.

Frost flowers salted the walls where the corridor finally widened into a cathedral-sized chamber. A scaffolding of struts and steam smothered an unseen light source, throwing the cables and elaborate grillwork spanning the ceiling into a sparse, shadowed flatness that reminded Rahel

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more of wrought iron than jumpship design. She stopped when one of the Larries picked at her shoulder. A cloud of her own breath washed back in her face with clammy staleness, and she was startled by how different it smelled from the rest of the air.

"I hope you guys don't expect me to go on without you." The rush and roar of some gas pumping device deadened her voice even in her own ears. "I can't see, and I don't know where you want me."

"Follow. No. Follow. Ending." Words like whispered vapor drifted down from above, so soft as to be only in Rahel's imagination. She craned her head upward in search of a speaker, but the Larry behind her pressed all four thorax arms against her back to keep her from moving away.

"Good breathing," the fragile voice pronounced. A puff of curling steam blasted outward from either side of the room's central strutting. "Wise air. Gertrude-this. Larries touching. Not-tlict you." The grillwork high above tipped downward, and every cable and structure in the room rearranged itself as the massive creature shifted position. "Gertrude-this."

Dizzy terror crammed a fist into Rahel's chest. Gasping, she clapped both hands to her mouth and stumbled backward a step to keep from falling to her knees. All four Larries scampered forward to preen their mammoth consort. Rahel didn't want to feel the prejudice—didn't want to fear anybody just because they were huge, and hideous, and impossibly different. But her eyes kept flying between the multiple joints and grippers, the bony plates of ornamentation, the workings of the Larries' mouths as they nursed at knobs along their Gertrude's belly, and Rahel found hard to ignore the primal instinct that said she shouldn't let this monstrosity exist in the same world with other people.

People in glass houses, her civilized brain reminded her sharply. After all, *she* was in the *tlict* jumpship—as the monster among them, she should probably exercise a little tolerance.

"Gertrude." Rahel wasn't sure if she'd actually found the breath to croak the single word, so cleared her throat and dropped her hands to call the greeting again. "Gertrude, my name is Rahel Tovin. I. . . . " She tried to think how to best acknowledge her reason for being here, then decided that discussing anything beyond the perfectly obvious would just get garbled in translation anyway. "Larry said you wanted to talk to me."

"Yes. Yes." Gertrude scraped arms on head crest to produce a hollow humming. "Not-tlict merchandise. Larries breathing. Gertrude-this. Worry."

"The merchandise." Rahel slipped her hands into her pockets. For some reason, the warm outline of the snooze pistol didn't feel as comforting as it once had. "The feral boy."

"Yes. Yes." The translator pressed to Gertrude's thorax purred breathily. "Not-tlict merchandise. Not-tlict you. Same. Yes? Same. No!"

"Yes." Rahel nodded. "The merchandise is human. He's what my

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people call a feral child. Can you . . . taste what 'feral' means?" Gertrude prodded at her Larries, but none of them gave any sign of understanding. "He grew up without the help of other humans. Like an animal. He can't function within human society, or even think like a human anymore."

"Worry. Worry." Gertrude's armor clacked like rifle shots as she shivered. Two of the Larries disengaged from their nursing, clawing at their mouths as if to clear them of some vile flavor. "Wild-not-tlict-not-think-larva-thing-that. Not-tlict merchandise. Damaged. Yes? Animal. No."

"No—not damaged."

"Animal," Gertrude persisted, shuddering her head crest. "Yes?"

Rahel sighed and scratched at her scalp. "No. I mean yes. I mean. . . . " She groaned and knotted both hands in her hair. "The merchandise is human," she finally said slowly, forcing herself to make eye contact with the gertrude. "The merchandise is also an animal. *All* humans are animals—"

"Not-tlict you. Tlict-think you. Yes? Yes?"

No. No. Big time no. "Humans are intelligent, yes. Very intelligent. But much of what we are is information that we learn—information that only happens if we keep in constant contact with other humans." Rahel watched the Larries huddle back against the Gertrude's legs to chew their pincers. "Except for that information and our ability to pass it on, we're just as much slaves to our instincts as the smallest paramecium."

Gertrude tasted every surface on her translator, rubbed it between her armored plates, tasted it again. "Not-tlict you." The translator buzzed. "Not-tlict you. Alone. Mature. Yes? Yes?"

Rahel tried to knit together the string of word concepts, but finally shook her head. "I don't understand."

"Larva-you. Adult-you. Not-alone. Change. Information. Change. Yes? Yes?" An expanse of bony arm stretched out above Rahel, then recoiled at the last moment as though unwilling to actually touch her. "Larva-you. Adult-you. Alone. Not-change. Not-information. Not-change."

"Humans never. . . . " Rahel spread her arms uncertainly. "We never change. We keep the same form all our lives."

"No!" Front legs pumping, Gertrude's barbed elbows scraped sparks against the metal walls. "Larva. Adult. Not-same. Can't-same. Never-same." Drops of light showered around her, singeing the Larries with a smell like burnt roses.

"There are differences as we become older," Rahel admitted. Backing out through the open door was probably not a good idea, no matter how attractive it might seem. "The way humans think, the way we move. All of that is different by the time we're finished growing. Brand new babies may share the same physical form as all other humans, but they aren't as well-developed, and they aren't nearly so large."

The rust-and-cream Larry used its lower arms to wrench one primary limb up close to its mouth parts. Ger-

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trude flicked the male away from her with a foot. "Not-tlict larva. Not-tlict grow." Great crest tipped from side to side, testing the torpid air. "Big. Grow. Not-change."

Rahel nodded. "That's right."

A splash of ammonia-bitter stench flared through the room. Rust-and-cream Larry jittered off in a circle, leaving his arm splashing in a pool of mustardy blood on the floor. Rahel jerked back into the doorway with her stomach riding a wave of acid up into her throat.

"Not-adult. Not-tlict." Something in Gertrude cracked like breaking glass when she pushed upright. "Abomination."

"It's our nature!" Rahel shoved both hands into her pants pockets, suddenly wanting the snooze pistol even though she no longer believed it could help her. "It's the way evolution made us—we didn't get any choice!"

Gertrude snatched another Larry out from under her, swinging it above her body almost as high as the ceiling. "Abomination," the translator whispered coolly. "Abomination. Not-tlict. You."

Skating for purchase on the smooth deck, Rahel pushed off against the doorjamb and tumbled as much as ran into the open corridor. A tlict body shattered against the bulkhead behind her. She felt the splash of fluid from its ruptured organs, heard the crash when it slid down the wall, choked against a surge of bile when the stink of the Larry's death chased her down the corridor. Horses panicked at the smell of blood; Savanna dogs could be whipped into a killing frenzy. Rahel didn't wait to find out what the tlict would do when perfumed by the scent of their own deaths.

She bolted the dark corridor with snooze pistol in hand, alert for the clatter of tlict feet on metal, primed to shoot any spindly movement ahead of her. No one and nothing tried to stop her. While the route proved significantly shorter at a dead run, Rahel suspected she had the slow diffusion rate of smell through atmosphere to thank, and not some sudden clemency on the part of the tlict. She slid into the airlock without slowing, slapping at the controls several more times than necessary. Even so, she could see tlict wandering into the corridor she'd just fled while the airlock hatch banged closed.

Running all the way back to her docking bay was simply impossible. Rahel realized that even as she banged on the outside lock door to try and make it open faster. The Interface was larger than most planetary cities, webbed together by transit tubes and slideways, and spiraling outward from its central hub like an intricate crystal helix. So when the tlict jumpship disgorged her, she jumped from the hatch without waiting for the gangway and made a head-down run for the nearest tube portal. As long as Larry didn't catch her before the next train screamed into station, she could be half a station away by the time her breathing slowed.

Plunging up the ramp to the transport level, Rahel caught the bulkhead to swing herself around the corner

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and into the tube train vestibule. An orange light throbbed above the row of open tube doors, and a sexless, species-less voice announced in conflicting languages, "This transport now departing for Docking Rings One, Four, and Nine, and for Central Hub Levels One through Seven. This transport now departing—"

"Wait!" Fear of failure—of being caught, of being killed by aliens who couldn't even explain what she'd done wrong—shocked her muscles with adrenaline and kicked her heart so fiercely she nearly went to all fours trying to scrabble the last distance. "Wait-wait-wait-wait-*wait!*" Her final lunge jammed one shoulder between the closing doors, then a twist wrenched her torso into the narrow opening, and another half-second's squirming squeezed the rest of her inside. Duacs scattered with yowls and jangles when she thumped to the train floor among them.

"Proctor Tovin." The glottal rattle preceding the *dkaktu*'s greeting was nearly lost in the shower of ringing that marked the tube train's slide into motion. "The mazhet welcome your barter."

She levered up on her elbows and earned a wet duac nose in the eye. "I'm glad somebody does," she grumbled, recoiling from cold snuffles at her nose and mouth. Pushing the duac's head irritably aside only made room for another cat to nudge in and take its place. Rahel finally had to struggle over onto her bottom so she could sit up and use both hands to fend off the curious paws and tongues and whiskers. "You know, I don't even let my dog give mouth kisses."

The duacs didn't seem impressed.

Climbing to her feet, she swiped half-heartedly at the sand and cream hairs clinging to her trousers, then glanced about at the slim statues crowding the silent train. The simple volume of mazhet pressed into the car was enough to drive a person colorblind. Rahel pinched the bridge of her nose, abruptly weary with a headache she hadn't realized she was nursing. "Did I just bull my way into some kind of private mazhet dining car or something?"

"The mazhet do not eat in public," the train's single *dhaktu* informed her. Rahel couldn't tell if one of the vibrant alien merchants had first clicked that little bit of data or not. "This vehicle is for transportation services only." A ribboned and turbaned mazhet with the scarlet robe and chain-link veil of a caravan *dohke* drifted its hand through the *dhaktu*'s silky topknot. "Do you wish to initiate barter? The mazhet may construct such facilities as needed."

"That depends." She shivered at the thought of where she'd just been, and scrubbed at her arms to try and warm them. "I have need of information."

The *dohke* blinked dark glass eyes lazily. "The mazhet possess all manner of information."

Which didn't surprise her in the least. "You even have the information I want, I suspect." She flicked a finger through a string of duac earrings and cocked her head across the train car at the *dohke*. "Can you tell me how long the mazhet have conducted deal-

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ings with the tlict?"

"No." The *dohke*'s only sound was the sparkling ring of its shaken hand. The *dhaktu*'s voice was ruthless.

Rahel resisted spitting a frustrated oath toward the floor. "How well do you know them, then?" she persisted. "I mean, if I had questions about how to handle my dealings with them, would the mazhet be able to supply me with answers?"

Another wave of ghostly chiming whispered through the car as it slowed to match up with another station. "Much about the tlict is not knowable." Sparks of light danced off the spangled arm the *dohke* raised to the wall beside it, gold coins fluttering like candle flames in the leftovers of the car's momentum. "Speaking to the color of your odor, it would seem your dealings with the tlict run quite deeply already."

"My odor?" She lifted her shirt front to sniff at it, then realized what the *dohke* must be saying just as the train doors sighed open on either of her. "You mean I *smell?*"

"Larry tasting." A dull tlict translator voice joined the clatter of multiple feet on the train car's floor. "Not-tlict you. Abomination."

Panic shot through her like lightning. Darting aside, she stumbled over scattering duacs and fetched up hard against a wall of mazhet in her effort to distance herself from the tlict. The Larry, his upper thorax already pushed through the open doors, struggled to cram his forward legs in as he flashed both primary arms with gripping spines extended. Rahel ducked down and back, into the silk aurora of brilliant mazhet finery—

And both tlict appendages snapped off above the elbow. Gripping spines, melted into a row of blackish knobs, splattered like chocolate where the arms hit the floor. Rahel didn't have time to recoil, nor did she even think to, before the tlict jerked back out the doors as if kicked. When the doors whisked shut to hide it, Larry had already thumped his abdomen flat to the floor, legs and arms and thorax curling into an awkward fist, like a spider left to dangle in the heart of the web where it had died.

Rahel crept forward on all fours. Beneath her hands, the narcotic thrumming of the train's drive engines felt as reassuring as her own heartbeat. "I . . . I'm. . . . " This time, the duacs made no effort to pad over and investigate.

A twinkle of movement picked out both the *dohke* and its attendant *dhaktu* as the translator helped slip some alien firearm back into the mazhet's sleeve. Rahel hadn't heard the gun fire, hadn't seen the muzzle flash, hadn't even felt the kiss of its thunderbolt passage. She took a deep breath and blinked away the image of the tlict's melted appendages and the gaudy ribbons of blood that strewed the floor around it. Doing barter with the mazhet no longer seemed the safe, trustworthy business it once had.

The *dohke* clicked in rhythm with its quiet ringing. "You have spoken with Gertrude." It wasn't a question, and neither the *dohke* nor its brightly dressed *dhaktu* bothered to look at her.

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Rahel nodded stiffly, then crawled unsteadily to her feet, careful not to reach out toward any of the mazhet for assistance. "I—well, yes," she finally stammered. "Gertrude sent for me."

"Irrelevant." Tapping the heads of three duacs in turn, the *dohke* touched its eyes one by one, then rang its veils by brushing hastily at its mouth. "That was unwise."

Rahel couldn't keep herself from snorting. "Tell me about it."

"What information did you convey?"

"I . . . I'm not sure. . . ." She scoured her hands against the legs of her trousers, then dragged her sleeves across her shirt as if that could help dislodge whatever smell the tlict had basted her with. "I'm not even sure what we were talking about. She had a lot of questions about the feral boy the mazhet bought for me last evening, and about how humans tell the difference between children and adults." She looked up at the *dohke,* shrugging helplessly. "At least, that's what I *think* she was asking. And what I think I told her."

The *dohke* laced elegant fingers into a single filigreed ball. "Did you reveal to her that humans may not necessarily be born self-aware?"

"What 'may not'?" Rahel judged from the *dhaktu*'s wrinkled forehead that her answer told them more than she'd meant it to. "I think we touched on the basics of society and observational learning. Why?"

Mazhet closed around her in a dervish of maddeningly color. Thin, cool hands grazed fleeting patterns on her cheeks. "You must leave the Interface." The *dhaktu*'s voice rose from somewhere out of sight behind the *dohke*'s left shoulder.

Rahel twisted side-to-side, only to find herself frowning up into the same impassive features wherever she turned. "Why do you think I was in such a hurry to squeeze myself into this transport?" It occurred to her that mazhet body odor reminded her faintly of cinnamon.

"Your ship will require a departure code to cast moorings from the station. You may use the mazhet code 3572019 and apply for immediate departure."

The numbers ricocheted into and out of her memory as she tried to split her attention between the wall of mazhet and any mnemonic that might help her remember the sequence. "The Newborns said I'd have to apply for a departure code twelve hours before I planned to ship out. Do they let you guys just keep a list of departure codes on hand or what?"

"The mazhet have a special arrangement," the *dohke* informed her with a lift of its chin. "Code 3572019 is valid for immediate departure. The mazhet extend it to you as an equitable service." Another of the mazhet clapped its hands twice, smartly. The *dohke* added with a bow, "Your employer will be invoiced for the execution of this contract."

At the moment, she didn't even care what kind of expenses that invoicing might entail.

"Aren't you guys gonna tell me what I did to flip the tlict out before

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I go?"

They stared back at her, even their bells and jewelry silent. Their infuriating calmness made her want to scream. "I'll pay you for it!"

A dozen voices rose up like a chorus of manic rad-counters, and Rahel found herself uncertain of who to talk to or where to look.

"What the tlict think of, how the tlict feel—much of this cannot be translated to creatures outside the web of tlict genetics." Human words reeled out of the racketing chaos almost too quickly for Rahel to follow. She wondered if the *dhaktu* spoke for one of the many mazhet, or all of them, or if it really mattered. "This the mazhet can say: Tlict at birth possess no minds. They possess only hunger, and a need for air and sunlight. In the first days of their lives, tlict children consume more than 70,000 times their own mass, and excrete only once. So rapid is their growth, they achieve adult proportions within seventeen days of birth. At this time, they exhibit the Change."

Larva-you. Adult-you . . . Change. Yes? "They turn into adults."

The *dohke* and thirteen other mazhet nodded gravely. "Tlict children who do not Change continue to eat, and grow, and reproduce themselves, but they never inherit the intelligence—the sentience—"

Rahel suspected the *dhaktu* inserted that clarification on his own.

"—Which the tlict judge holds them separate from all senseless, unaware animals. Including their own mindless young."

Every shudder, scuttle, and tortured half-sentence ground together in her memory like slabs of crushing stone. Caught beneath the weight of her redefined knowledge, Rahel poked through the rubble of what had come before. "I told her we grew up, looking just the same from baby to adulthood. I told her . . ." she scrubbed her eyes with the heels of her hands and groaned, " . . . that we were animals, every last human in existence. Just like paramecia."

"You told her worse than that." The *dhaktu* said it, but it sounded like most of the mazhet actually uttered the response. "You told her that humans are unChanged children, abominations who would feed themselves to the destruction of everything else around them. You told her that humans cannot be lived with or trusted."

Rahel glanced up into the nearest mazhet countenance. "What do the tlict do with the children who never make the Change?"

The *dohke* alone gave her the answer. "On the eighteenth day, the adults kill them."

"I've got to get off this station." She made a desperate circle within the knot of mazhet. *"Everybody's* got to get offstation." Everybody human, at least. "Is there some way to get word out to the other human visitors? Through the Newborn administrators, maybe?"

The *dohke* inclined its head. "Shall this be accepted as an addendum to your contract with the mazhet?"

Rahel was horrified to think how much her blunder was costing. "Yes!"

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"This is equitable." The *dohke* flicked its hands in a double chime. "It shall be done." Then it proffered one palm with a delicate mazhet flourish, and waited.

"What?" Not sure what else to do, Rahel slowly slipped her own hand on top of the alien's. The *dohke* curled its fingers around her wrist to turn her hand palm upright. "What?" she asked again. One involuntary tug as the *dohke* accepted some small, narrow tool from another mazhet proved she couldn't pull herself free, so she didn't try again. "If you don't mind, I'm kind of in a hurry."

"The departure code." Mazhet tool touched skin, and pain cut through her palm deep enough to sear the bones. Rahel barked a short scream and this time tried to yank herself free in earnest. Even throwing the whole weight of her body into the pull didn't break the *dohke*'s grip, and mazhet hands at shoulders and elbows discouraged her from fighting further. She clenched her eyes and her jaw, barely noticing the tears that stung her cheeks while the *dohke* etched seven numbers into her palm so precisely she could see their shapes carved in fire at the back of her brain.

"Now," the mazhet said at last, releasing her with chill indifference. "You will remember."

I'll never forget. Rahel hugged her fist under her chin until she choked up enough courage to crack her eyes and peel her fingers away. Seven shiny, black figures marched with ruler-like alignment across her unburnt palm. Like a freshly printed flimsy, or calligraphied ink. Except these numbers didn't rub off when she smudged at them with her thumb.

"After all that. . . . " She closed her fist with a shaky sigh. "This number had better be a good one."

The train doors shushed open onto the corridor tracing the foot of her docking bay. "The mazhet do not lie. Nor do the mazhet dishonor a barter." Mazhet and duacs moved gracefully aside to open a kaleidoscopic path toward the exit. "But move quickly. The tlict may do both, and do both with equal facility."

Her hand still throbbed while she waited for the airlock on her jumpship to admit her. First thing after casting moorings, she'd poke and prod whatever she could reach in her palm with the ship's smartdoc. Maybe she could find out how she could have no cuts or bruises and still hurt so damn bad. *But not before I'm moving,* she advised herself when the door finally slid open and let her inside. Odds were nobody complained much about pain from inside a tlict Gertrude's belly, so it really wouldn't matter if she didn't first make good her getaway.

The *clitter-skitter-scatter* of toenails all over decking announced the approach of Toad's greeting dance. Rahel laughed as the puppy galloped over in an ever contracting sequence of spirals and bounds. She finally snugged herself up against Rahel's legs tight enough to blow wet snorts into Rahel's hands at the same time as she thumped her butt and wagged her tail in alternating rhythms of wor-

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shipful joy. Puppy hair and breath smelled strongly of dog food grease, and Toad's belly looked round enough to hide a casaba melon.

Rahel shook the dog's big, ugly head and drummed her hands against Toad's ribcage. Toad raised her nose with a grunt, then belched indelicately. "Someone's been a piggy with the dog food." Rahel grapped a double handful of loose skin and moved it back and forth across Toad's shoulders. "What're you doing in the storeroom, anyway? I thought I left you—"

In the lounge. With the feral boy.

Swinging around the doorway to find the soft-cuff and tether intact but empty didn't surprise Rahel nearly as much as finding out the boy had opened the lounge door with nobody to help him but Toad. Her own damn fault, she admitted with a curse. Feral or no, he was still one of the brightest species to ever grace the Galaxy, and this jumpship had been designed to accommodate people with a lot less motivation than he had. She should never have made the mistake of expecting him to accept his captivity so readily.

"Boy!" Stumbling over Toad to get back into the hallway, she trotted with the puppy on her heels into the passenger sleeping area, Toad's playroom, and the lab. "Come on, boy, don't do this to me! Where are you?" Because she couldn't leave unless she knew he was on board. The thought of ruining humanity's relationship with the tlict, running up a lifelong debt with the mazhet, and getting Noah's Ark kicked off the Interface without at least going home with the one thing she'd legitimately paid for was a little too crazy-making, even for her. *"Boy!"* Please, God, let him still be on board.

"I have the results of the gene spin and cross-match you requested for Feral Aral #1," the testing station AI informed her when she darted through the lab to glance into the back sampling area. "Would you like a visual display or an audio summation?"

Both. Neither. She didn't have time to pore over the genetics of a specimen she wasn't even sure she still possessed. Still, she couldn't make herself run off without getting at least the most basic of answers. Pausing to fidget guiltily in the doorway, she called, "Give me the short version. Where's he from?"

"Unknown. Feral Aral #1 displays no genetic affinity with any *Homo sapiens* population currently cataloged by Noah's Ark."

Shock jerked her back into the room when she would have dashed away after only half-listening. "But that's impossible." As if the AI would lie. As if genetics *could* lie. "He is *Homo sapiens,* isn't he?"

"Yes."

"Then he's got to have a closest ancestor in the database."

"Feral Aral #1's closest ancestor falls outside my genotype modeling parameters by greater than 25,000 generations."

"Oh, my God. . . . " This little boy, with his childish stature and narrow build, came from a bloodline that hadn't crossbred with Terran humans for better than 750,000 years. When Nadder said she didn't carry genuine

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animals, she was lying—this boy was more genuine than anything else Nadder could have said her.

Rahel knew with sudden, bitter certainty that there was no way she could leave the station without the rest of Nadder's cargo.

"Come on, Toad. I—Toad?" She looked up and down the empty corridor with a growl of frustration. It must be an annoying feral thing to wander away when no one was watching you. "C'mere, Spud! Toad?" She clapped her hands and whistled. "C'mere, you replaceable little tub of trouble!"

Echoing adolescent yaps rang out from the rearmost storage compartment. Where the dog food was kept, of course. A four-month-old terrier was nothing if not self-indulgent. Rahel jogged to the end of the hallway, already planning how she would explain to Saiah Innis that she'd somehow misplaced the greatest biological discovery of this century.

Too gorged to feed herself, Toad sat atop a spill of crunchy dog kibble and contentedly watched her friend chew on a handful with cautious uncertainty. Not the most nutritious fare, even given this boy's past history. Maybe dog food smelled good when you'd been raised by wolves. Stepping over the boy, Rahel grabbed a few seal-meals at random, then bent to take hold of his arm. "You can eat all the dog food you want once we're off of this station, but right now we've got to haul ass."

The boy lunged away from her grip, barking with surprise. Rahel dropped hard onto one knee to keep from having to loosen her hold. "Listen to me . . . " She balanced the stack of meals across her thigh and reached out to gently stroke his arm. Toad wiggled in between them to pursue her hand with sloppy licks. "I wish I could explain to you why everything that's happening is important, but I can't. I wish *you* could explain to *me* how you and a bunch of extinct Terran animals ended up out here before mankind had even invented the wheel, but you can't. You're just gonna have to listen to my voice the way Toad does and understand that I'm not gonna hurt you. Look—she trusts me." Rahel fondled a hand across the puppy's face and folded-down ears. "Can't you?"

Eyes the same dark chocolate as Toad's watched while the puppy squirmed and wiggled in response to Rahel's petting. A little of the angry hardness seeped out of the boy's tense muscles. When he cocked his head to aim a suspicious glare up at her, though, the naked intellect reflected in his eyes slapped Rahel's face with embarrassment.

"I don't know if you being stupid would make this easier or harder." Standing slowly, she let him pull himself to his feet without guiding him the way she would some recalcitrant child.

"Well, that takes care of at least one of our little problems." She backed into the corridor, then smiled when he followed with only the most requisite amount of wariness. "Now—let's see how fast you can run."

Medve's docking bay stank of alien

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pheromones and burning polycarbons. The scream of working lasers somewhere out of sight made the boy jerk to a startled stop, and Rahel had to tug at the tail of his T-shirt to drag him along when she started down the access ramp. He trotted up even with her hip, seal-meals clutched possessively to his chest with both hands, and frowned at the broken splashes of light erupting from beyond *Medve*'s landing pylons. Rahel wondered if he just didn't like the noise, or if he knew something she didn't about what Nadder played with while hiding out behind her jumpship. Toad was no help—she bumped happily along behind them, growling, her leash clamped between her teeth. She wouldn't have noticed a problem if it bit her on the behind.

The laser light extinguished before they'd made it half-way across the bay, throwing the dock into startling darkness and clearing the air for whispered curses and the scrape of metal against something more yielding. Rahel half-expected to find Nadder and her assistant dismantling animal crates in an attempt to do away with evidence of their crimes. But when the albino backed into view around the jumpship's nose, his welding gloves were sticky with rotten-mustard blood instead of welding flux, and the long, jointed segment he dragged across the deck behind him looked distinctly organic in nature. Rahel stopped where she was and squeezed her hand just above the boy's elbow to hold him from running.

Nadder, another length of tlict leg balanced over each shoulder, planted both feet when she rounded the jumpship in turn. Her opaque faceguard pointed at Rahel in what could only be a glare. "Why, you sneaky little eco-wench! Where the hell did you get *him?*"

The sliding slap of seal-meals hitting the deck was Rahel's only warning. She dropped Toad's leash and spun to grab the boy with both hands, closing her right fist on nothing but T-shirt when he twisted himself almost completely behind her. With one hand still locked on his elbow, though, that was leverage enough. Hauling back on the fistful of T-shirt, she leapt forward and swept her arms around him as his bare feet lost purchase on the decking. He shouted in anger, nearly crawling up her front in his effort to get away, but she managed to crook one arm around his neck just before he cracked her chin with the top of his head. He answered her with a stamp of his feet and the warm snap of teeth on her wrist.

"Don't even think it!"

The boy rolled an angry lower lip at her, but, surprisingly, didn't bite down.

"You so much as give me a love nip, you little throwback, and I'll have the vet yank all your teeth while he's got you in for neutering. You understand me?"

Before words were invented, there was tone of voice. Even 750,000 years of evolution couldn't erase that common heritage. Rahel waited until he eased his jaw open and backed his head away, then slowly loosened her own grip around his throat.

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"Good boy," she said sweetly, in just the right tone to make Toad look up from the floor and wag her tail. Later, when he knew enough words to make explanations worthwhile, she'd worry about constructing a better reinforcement for good behavior. Right now, though, she settled for rubbing his shoulder and plastering on an artificial smile. "That's a good boy."

"That's better progress than I ever made with him. I was just about ready to wire his jaw." Nadder knocked the face guard up over her forehead, stalking forward to peer at the boy with professional interest. He backed closer against Rahel, but didn't try to run. "So—did you actually send the mazhet out here to get him, or did their *dohke* cut a deal with you after the mazhet knew what they were buying?"

Rahel kept her hands on the boy as she guided him around behind her, just as happy to keep him touching her and out of Nadder's reach. "How I got him doesn't matter. We've got bigger problems, you and me." She nodded toward the Larry parts Nadder's albino was so diligently stuffing down the matter reclamater in the docking bay's wall. "There's gonna be a lot more of them, you know. One tlict more or less won't help a lot in the great big scheme of things."

Nadder picked up one end of a leg when the albino scurried back to her, shoving it into his arms without taking her eyes off Rahel. "You don't have the faintest idea what's going on here."

"Then I'll take a wild guess. You were doing some kind of business with Larry here when he started getting psycho. Maybe you killed him—maybe he killed himself. What matters is that you ended up with a dead tlict and no good explanation for how he got that way." Rahel watched the albino force another length of leg down the wall with a tooth-grinding buzz. "Now you're disposing of the body."

Nadder pursed thin lips into a pensive frown, tugging on the cuffs of her welding gloves, picking at the seams. Somewhere behind Rahel, the boy started gathering up the dropped sealmeals in furtive grabs. "What is it you want from me?" Nadder asked her coldly.

Rahel stooped to sweep a few outlying meals in the boy's direction. "I want the same thing you do—to get offstation before the tlict come to find us."

"Well, then help us clean up the rest of this mess." Nadder jerked her thumb at the rest of the tlict on the other side of the jumpship. " 'Cause I put in for a departure code when Larry first tried to take Styen's head off. Traffic Control said we'd be on queue at least six hours." She spread her hands and took a few steps backwards toward the hidden work area. "Or are you in too much of a hurry to wait around while we chop-chop?"

Rahel shook her head, winding Toad's leash up around one hand. "I don't have to wait around. I can go back to my jumpship and be gone in fifteen minutes." She smiled thinly when Nadder slammed to a stop and grimaced suspiciously. "I don't have

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to take you with me, Nadder, but you've got what I want, and I've got what you need. I thought we might find some happy middle ground before we all ended up as Larry food."

"Sonofabitch." The word burst out of Nadder on a short, soft puff of laughter. "You've got a mazhet departure code!" She dropped her fists to her hips in belligerent awe.

Rahel wondered how impressed Nadder would be if she knew what Rahel had done to necessitate getting the number. "And you've got Terran-descendant genotypes that haven't seen a common Earth ancestor in 750,000 years." She reached around behind her to hook a finger in the boy's T-shirt collar. Nadder lifted one eyebrow at first Rahel, then the boy. "I want your cargo," Rahel told her flatly. "All of it. And I want to be on board with it when you pull out."

"Bullshit." Nadder slapped the face guard back down into place. "You can't just take all my merchandise without paying me for it. That's piracy!"

"I'm paying you with your life."

"Which won't be worth shit if I have to welsh on certain financial obligations." Nadder tossed the albino the cutting torch off her belt and pushed him in the direction of where they'd left the rest of the body. He ducked under the jumpship's nose and disappeared from sight. "At least give me two-thirds the going rate for anything you decide to keep."

As if Rahel or anyone else she knew could quote the going rate for black-market genotypes. "One-third going price," Rahel countered. "And that's generous for illegal merchandise."

Nadder shook her head, the slow, knowing gesture of someone much older and wiser in the ways of the evil world. "Half-price." The arc light of more tlict dismantling illuminated the bay behind Nadder. "And I won't tell the authorities you arranged for a slave trade using the mazhet as your agents."

My problem, Rahel thought as she glowered at her own reflection in Nadder's anodized mask, *is that I'm just not slimy enough to make good use of my options.*

"Half-price or nothing." Nadder's voice rose to a surprising sharpness as she took two rapid steps backward and brought her hands off her hips. "Decide fast!"

Toad slammed the end of her leash hard enough to jerk Rahel half-way around toward the entrance, punctuating her barking with a cataract of wild snarls. The Larries at the docking bay doors cringed into a tangle of legs, arms, and flailing mouths. For an instant, that writhing mass looked too much like Gertrude in her too-small cathedral. Rahel jerked Toad up into her arms and ran toward *Medve* with the puppy howling dire threats over her shoulder. "Interface! Traffic Control!"

"Interface Traffic Control." The Newborn's voice echoed over the bay's invisible intercom far too calmly to have any idea what was going on. "Online."

"Departure code—" She shrugged Toad further up on her shoulder to squint at her palm between the puppy's hind legs. "—3752019. Seal off

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our bay and queue *Medve* for immediate departure!"

Rahel snagged the boy's hem when he dashed across in front of her, trying to aim him for the airlock and not the deceptive safety of the gap beneath the ship. "This way! This way!" He hitched up short, nearly tripping her, then ducked away from Nadder and her albino when they clambered into the airlock with their welding gear in tow. The main bay doors thundered closed, but Rahel didn't dare turn to see whether any of the Larries had made it through.

"Query, *Medve,"* the Newborn interjected politely.

"Dammit, not now!" Rahel dropped Toad without releasing her lead and swerved to intercept the boy with her shoulder. He squealed once as she lurched upright and hauled him off the ground, then grabbed frantically for her belt to keep from pitching off her back completely. To his credit, he didn't try to bite her.

"Traffic Control recognizes 3572019 as a mazhet departure code. Please clarify the nature of your possession."

Nadder planted her hand on the edge of the airlock to hold it open while Rahel pitched the boy inside. "We bought it from them!"

The Newborn hesitated long enough for Rahel to jump in on top of the boy and Nadder to reel up Toad's leash and bring the puppy aboard. "Transaction noted," the robot finally stated flatly. "Class three transport *Medve,* you are cleared for immediate departure. Cast off moorings at will."

The inside lock door sprang aside, and Nadder shoved both hands against her albino's back even though he was already up and running for the pilot's station. "You heard the Newbie—we're clear! Get us moving!" He wasn't even in sight by the time she added, "Go, goddam you! Go!"

The soundless thrum of maneuvering thrusters rumbled through the jumpship's deck like a dragon's purr. Sinking back against the airlock bulkhead, Rahel let the boy skitter out from under her and all-four it into the central chamber, where he crammed himself into the corner by a maintenance locker. Not that it mattered where he went now—there wasn't a ship in existence that would let him open an outside door without a suit on. He could hide under the furniture all the way home for all Rahel cared. It would certainly simplify keeping tabs on him.

Fending off Toad's curiosity with her elbows, Rahel peeled the seals off three of the dinners and skated them across the deck at the boy while he watched the food travel with dubious longing. Toad scrambled in place with excitement before bolting off after the dishes. Rahel met the boy's gaze and shrugged while Toad attacked the first plate. "So get up and fight with her. But don't come crying to me if your sister hogs it all."

Nadder laughed softly, wandering aimlessly back and forth through the airlock as she picked up welder pieces. "What're you going to do with him once you get him back to Noah's Ark?" she asked, stepping over Rahel's legs to fish out some part from behind the small of her back. "I

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mean, how long can he keep the lot of you busy, being just the one little guy and all?"

One little guy with a lot of big mysteries. Rahel sighed, watching him creep out of hiding to play tug-of-war with Toad over one of the plates. "If we're lucky, he'll be another step on the way to finding out how Terran-original genotypes found their way to this end of the Galaxy, and why. He'll also provide the first real chance we've ever had to look at what kind of genetic drift occurs in a truly isolated human population. Between him and the rest of your cargo, we're not going to be at a loss for things to do." She pried up the corner on another of the meal packets and sniffed at the contents to see if her stomach was hungry.

"Aw, hell. . . . " Nadder hoisted the bits of bloody equipment and dragged them toward the locker the boy had just deserted. "Haven't you figured it out yet? You're not gonna take my cargo." She dumped the load unceremoniously into the locker. "You're not gonna want it."

Rahel lowered the food tray back to her lap. "What are you talking about?"

To her surprise, Nadder only laughed again and settled contentedly back against the locker door. "I've got a storehold full of animals, all right," she said, smiling. "Fifteen hundred suspension coffins, and none of 'em carrying anything more exotic than a legal-bought budgerigar tailored to look like a Carolina parakeet. They're fakes!" The marketeer tossed her arms wide with hapless delight. "Every last one of 'em! And I sell 'em to fashion-conscious idiots who don't know how to tell the difference. I'll even let you examine 'em, if you want to, 'cause I know what you're gonna find."

"But. . . ." Rahel blinked a flustered look at where the boy crouched with Toad, picking green beans out of his ramen and dropping them down for the puppy to gobble. She couldn't remember if she'd noticed that he used his hands to eat before. She wasn't even sure if that was significant. "I ran his gene spins. He's *Homo sapiens,* and he's *not* from Earth. You can't fake raw data like that!"

Nadder shrugged and folded her arms. "I'm sure you can't. But I never had to. The couple times I stumbled across anything Terran-original, it was just 'cause I could pick it up cheap. It's not like they'd sell for any more than my dress-ups do. Naw, I got your boy from the same place I got the couple other Terran genotypes that probably lured you here, proctor." She sighed at the boy with a certain touch of ironic fondness, and smiled. "I bought him from the tlict."

"What do you mean you lost the jumpship?"

Frustrated, exhausted, Rahel couldn't be bothered to lift her head from her hands and see what expression accompanied Paval's disbelieving squeak across the comlink. "I left it at the Interface. It wasn't like I had a lot of time to consider better options."

"Taking the jumpship wasn't an option?"

Rahel cocked a glare at the comlink

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screen, and Paval returned her look with a scowl of equal annoyance. "Considering everything leading up to my decision," she told him, "no, I didn't think it was."

Paval sat back in his chair and rubbed his hands across his face as if he'd been waiting all night just to hear this depressing news. "Well, what am I supposed to tell Proctor Innis?" he asked, a little peevishly. "He's already angry about this bill from the mazhet, and everyone else is angry about whatever happened with the tlict." He sighed the deep, soulful sigh of the young. "Proctor Tovin, you're supposed to be setting me a good example, but all I end up getting is confused."

"And sarcastic." She turned half away from the comlink to check on the passenger tucked comfortably under her bed. He'd taken the blankets and all the extra pillows, and now all she could see of him was one elbow and the top of his shaven head from somewhere inside the fluffy bundle. Even Toad had been chased out of the boy's makeshift habitat when she'd tried to cuddle up with him for softness. "At least I'm not coming back empty-handed. Tell Saiah I'm bringing home an animal more valuable than anything we ever thought he sent me for."

"A Terran animal? Really?" Paval sat up attentively from more than a hundred light-years away. "How many? What kind?"

"One. The most successful, complicated, and misunderstood animal on Interface station. And a kind Noah's Ark has never really worked with before." Rahel watched the boy roll over in his sleep, hugging himself into a ball as small as a baby and as complicated as the world. "I just hope we're up to the challenge." ■

EDITOR'S NOTE: *This story is part of the author's "Noah's Ark" series, which also includes "Blood Relations" (June 1992), "Ice Nights" (October 1992), and "Tide of Stars" (January 1995).*

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James P. Hogan

FACT-FREE SCIENCE

Regardless of how elegantly a scientific theory is constructed, or how satisfyingly it might fit one's ideas of the way things ought to be, the *facts* determine whether or not it is actually true. This is what makes it science, as opposed to various other ways of arriving at beliefs that people have been dreaming up through the riot of human behavior that we call recorded history.

However, beliefs don't have to be true to be effective. One of the problems that results from undue political influence over what gets presented to the public as science—either through direct tax-dollar funding, or via ties with the institutions who in turn promote the research—is conflict of motives. Policymakers and the bureaucrats who serve them are interested in promoting beliefs that will advance their political agendas; the perceived consequences are what make a belief acceptable. Science is concerned with what's true. Facts decide what is believed, and the consequences—good or bad, which is a separate issue—fall where they will.

At least, that's how science would work in any ideal world. But with support coming to depend more on official approval, what we seem to be getting instead is the unchallenged spread as scientifically proven of politically correct dogmas that appear to fly in the face of a few elementary, and readily verifiable, inconvenient facts.

Take, for instance, the commonly heard assertion that "no level of radiation is safe"—in other words, any exposure to ionizing radiation, however small, is damaging to health. In fact, at the levels encountered ordinarily—i.e. excluding bomb victims and patients subjected to massive medical doses, usually as a last resort in terminal situations—no conclusive results are observed at all. Low-level effects are *inferred* by taking a known high-level point where a definite effect can

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be measured, and assuming that it connects to the zero-point (zero dose, therefore zero effect) as a straight line. From this it is possible to read off as an act of faith the pro-rata effects that small doses ought to have. This is a bit like saying that since a temperature of 1000°C is lethal, 1° kills 1/1000th of a person, and therefore raising the temperatures of all the classrooms in American schools by 2° will kill so many million children. This is the kind of model that the figures the media are so fond of blaring are based on. Yet research that has been known to the health and radiation physics community for many years indicates that it is wrong.

Trying to emulate the labors of Hercules would cause most of us to drop dead from exhaustion. Nevertheless, jogging a few miles a week makes lots of people feel good and keeps them in shape. A dip in the boilers of a power plant would be decidedly damaging to one's health; but soaking in a hot tub is relaxing. Things that get lethal when taken to extremes are often beneficial in small quantities.

This has long been acknowledged for chemical and biological toxins. Trace amounts of germicides can *increase* fermentation of bacteria. Too-small doses of antibiotics will stimulate growth of dormant bacteria that they are supposed to kill. A moderate amount of exercise keeps the immune system fit and in good tone, no less than muscles. The phenomenon is known as "hormesis," from the Greek *hormo,* meaning "to stimulate."

For about a decade, evidence has been mounting that hormesis holds true also for ionizing radiation. Not that sunbathing during a nuclear strike is good for you; but low levels aren't as bad as many would have us believe.

In the early eighties, Professor T.D. Luckey, a biochemist at the University of Missouri, published a study[1] of over 1200 experiments dating back to the turn of the century on the effects of low-level radiation on biota ranging from viruses, bacteria, and fungi through various plants and animals up to vertebrates. He found that, by all the criteria normally used to judge the well-being of living things, modest increases above the natural background make life better: they grow bigger and faster; they live longer; they get sick less often and recover sooner; they produce more offspring, more of which survive.

And the same appears to be true also of humans.[2,3,4] The state that the EPA found as having the highest average level of radon in the home, Iowa, also has below-average cancer incidence.[5] The mountain states, with double the radiation background of the US as a whole (cosmic rays are stronger at higher altitudes, and the rocks in those states have a high radioactive content), show a cancer rate way below Iowa's. The negative correlation—more radiation, less cancer—holds for the U.S. in general and extends worldwide.[4] The waters of such European spas as Lourdes, Bath, and Bad Gastein, known for their beneficial health effects since Roman times, are all found to have high radioactivity levels. British data on over

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10,000 UK Atomic Energy Authority workers show cancer mortality to be 22% below the national average, while for Canada the figure is 33%.[6] Imagine the hysteria if those numbers were the other way around.

This can all be represented by not a straight line, but a curve shaped like a "J," sloping upward to the right. Dose increases to the right; the damage that results is measured vertically. The leftmost tip of the J represents the point of no dose/no effect. ("No dose" means nothing above background. There's some natural background everywhere. You can't get away from it.) At first the curve goes down, meaning that the "damage" is negative, which is what we've been saying. It reaches an optimum at the bottom, and then turns upward—we're still better off than with no dose at all, but getting less comfortable. The beneficial effect disappears where the curve crosses its starting level again, and beyond that we experience progressively greater distress, and, eventually, death.

So what optimum dose should our local health-food store recommend? Recent work reported from Japan puts it roughly at two thousandths of a "rem," or two "millirems," per day. That's about a tenth of a dental X-ray, or one coast-to-coast jet flight, or a year's worth of standing beside a nuclear plant. For comparison, the crossover where the net effect becomes harmful is at around two rems per day; 50 (note, we're talking rems now, not millirems) causes chronic radiation sickness, and 100 is lethal.

On this basis, if regulatory authorities set their exposure limits too low, i.e. to the left of where the J bottoms out, then reducing levels to comply with them can actually make things worse. In a study of homes across 1,729 U.S. counties[8], Bernard Cohen, professor of physics and radiation health at the University of Pittsburgh, has found a correlation between radon levels and lung cancer mortality almost as high as that for cigarette smoking. Except, it's in the opposite direction: As radon goes up, cancer goes down.

Perhaps tablets for those who don't get enough regular exposure wouldn't be a bad idea. Or a good way to use radioactive waste might be to bury it underneath radon-deficient homes. And perhaps cereal manufacturers should be required to state on their boxes the percentage of the daily dietary requirement that a portion of their product contributes. After all, if radiation is essential for health in minimum, regular amounts, it meets (except for not being an "organic substance") the accepted definition of a vitamin!

The June 1993 issue of *Omni* carried an article of mine on the ozone controversy in which I said that the bottom-line test, after all the modeling and involved arguments over atmospheric chemistry, was the ultraviolet light reaching the Earth's surface. If stratospheric ozone were under relentless chemical attack in the way that we're told, the measured UV ought to be increasing. People who have measured it say it isn't.

In 1988, Joseph Scotto of the National Cancer Institute published data

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from eight U.S. ground stations showing that UV-B (the wavelength band affected by ozone) decreased by amounts ranging from 2 to 7% during the period 1974-1985[9]. A similar politically incorrect trend was recorded over 15 years ago by the Fraunhofer Institute of Atmospheric Sciences in Bavaria, Germany[10].

The response? Scotto's study was ignored by the international news media. He was denied funding to attend international conferences to present his findings, and the ground stations were closed down. The costs of accepting the depletion theory as true will run into billions of dollars, but apparently we can't afford a few thousand to collect the data most fundamental to testing it. In Washington, scientists who objected were attacked by environmentalist pressure groups, and former Princeton physics professor William Happer, who opposed the present administration and wanted to set up an extended instrumentation network, was dismissed from his post as research director at the Department of Energy. The retiring head of the German program was replaced by a depletionist who refused to publish the institute's accumulated data and terminated further measurements, apparently on the grounds that future policy would be to rely on computer models instead[11](!).

Critics jeered, and the depletion lobby was not happy. Then, after a lengthy silence, a paper appeared in *Science,* claiming that upward trends in UV-B were linked to ozone depletion after all [12]. So suddenly, all of the foregoing was wrong. the party line had been right all along. Depletion was real.

The study showed plots of ozone above Toronto declining steadily through 1989-1993, and UV increasing in step over the same period. But Dr. Arthur Robinson, a biochemist at the Oregon Institute of Science and Medicine (which is privately funded), notices something curious: Although the whole point was supposed to be the discovery of a correlation between decreasing ozone and increasing UV-B, nowhere in the study was there a graph relating these two quantities one to the other [13]. Neither were there any numbers that would enable such a graph to be constructed. Robinson enlarged the published plots and performed his own analysis. And the reason why no consequential trend line was shown, he discovered, was that there was no trend.

For the first four years the ozone and UV-B rose and fell together: completely opposite to what the paper claimed to show. The result wouldn't have surprised depletion skeptics, however, who never accepted that UV has to go up as ozone goes down, in the first place. Rather, since UV creates ozone out of oxygen in the upper atmosphere, more UV getting through means that more ozone is being made up there. Hence, all else being equal, both quantities should change together with the seasonal variations and fluctuations of the Sun. And the 1989-1992 pattern shows just that.

But all else isn't always equal. Ozone worldwide fell through the

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second half of 1992 to reach an extraordinarily low level in 1993. Satellite maps for this period show the diffusion through the stratosphere of huge plumes of sulfur dioxide from the Mt. Pinatubo volcano eruption in 1991. This would extend to global dimensions the depletion chemistry usually restricted to polar ice clouds (and responsible for the notorious Antarctic "hole"—replacement can't occur in the winter months because there's no sun).

So the low 1993 ozone was not caused by unusually low solar activity. Solar activity was normal, which of course gave above-normal UV intensity with the chemically thinned ozone cover. This one-time event was then stretched out to create an illusory trend beginning in 1989. In fact, it was produced from just four high readings out of more than 300 data points[14].

Logically, this would be like proving to the landlord that there's damp rising in the house by waiting for a flood and then averaging the effect back over four years. If the lawyers catch onto this one, it could open up a whole new world of liability actions.

People once thought that the skies turned about them. Then they noticed that the "planets" (Greek: "wanderer") moved against the background of stars, sometimes pulling ahead of the herd, sometimes falling behind. They managed to account for it by superposing smaller circles, or "epicycles," on the main circles. More accurate observations added epicycles to the epicycles, until by the Middle Ages the motions had become so complicated that no law of forces devisable by the human mind could accommodate them. The system could explain anything, but only after the facts were known. Then Copernicus put the Sun in the center, and suddenly all was simple. Kepler and Newton took it from there, and the predictive science of modern astronomy quickly followed.

HIV must be one of the most bewildering objects to challenge comprehension. And that's odd in itself, for as biological entities go, viruses are rather simple.

In the early eighties, clusters of certain known diseases were appearing with above-average incidence. For reasons that remain obscure it was decided that they were all due to a breakdown of the immune system, although only about 60% would normally be thought of as involving immunosuppression. Viruses were much in vogue at the time, which immediately prompted searches in that direction for a cause. In 1984 the Health and Human Services secretary announced that HIV had been identified as the AIDS virus, and promised a vaccine within two years. Viral diseases are infectious, and with no countermeasures available, a sexually transmitted epidemic "exploding" through the population at large was direly predicted.

But the epidemic didn't happen. AIDS diseases remained overwhelmingly confined to the same, readily identifiable, behavior-related risk groups, and within those groups over 90% of the victims were male[15,16]. That isn't the pattern of infectious dis-

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eases, which spread and tend to be distributed equally. But instead of questioning the theory, the official response was a redefinition of AIDS to cover more previously known diseases; hence, what wasn't AIDS one day became AIDS the next, causing bigger numbers to be diagnosed. This happened five times from 1982 to 1993. As a result, the first nine months of 1993 showed as a 5% rise what would otherwise (i.e. by the 1992 definition) have been a 33% drop[17]. One of the new categories was cervical cancer—so now women were affected more equally too.

Viruses make you sick by killing cells. Flu infects 30% of the lung cells, and hepatitis almost every cell of the liver. Yet with even terminal AIDS patients, only 1 in 1000, on average, of the immune system's T-cells show HIV. In fact, HIV is so difficult to find that the "AIDS test" doesn't test for the virus at all, but for the antibody. So "HIV positive" really means HIV-immune. This turns nearly two hundred years of medicine on its head. For any other disease, presence of the antibody is taken as indicating that the body has acquired resistance, not that it is susceptible and requires preemptive treatment.

To explain this, it was postulated that HIV doesn't kill T-cells directly, but by somehow tricking the immune system into attacking itself. But tens of thousands of HIV positives continued walking around quite healthily. Why weren't their immune systems committing *hara-kiri?* Ah, yes, well. . . .

Because HIV on its own isn't enough. It requires an unspecified "cofactor," you see. Or maybe cofactors. Others decided that it was a "slow" virus with a ten-month latency, which was why the expected epidemic was being slow. But viruses don't typically work that way. Infectious agents reproduce if they get a hold, and take effect within days or weeks. Sickness after long latencies is characteristic of the cumulative buildup of a toxin. When the ten month prediction didn't happen either, its proponents changed it to five years. Five years went by and the world didn't end, so they upped it to ten.

Then it was admitted that not only could you have HIV without getting AIDS, but thousands of cases existed of AIDS with no HIV—surely making it the most extraordinary causative agent ever discovered. Nobody ever heard of polio without polio viruses. The self-contradiction was conjured away by giving it a different name and claiming that it doesn't happen. So now, if you have all the symptoms that would qualify unhesitatingly as AIDS if you checked HIV positive, but as it happens you don't, then you're suffering from idiopathic-CD4-lymphocytopenia, which is obscurese for HIV-free AIDS.

Currently, two billion dollars per year are being spent to unravel the paradox of how the HIV antibody fails to confer immunity while neutralizing the virus; no mechanism has been found for how HIV kills T-cells; and no vaccine is in sight. The viricentric theory fails every prediction, and always another epicycle is added to ex-

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plain why. But the "paradoxes" disappear if Peter Duesberg has been right all along, and HIV doesn't cause AIDS at all[18].

Professor Duesberg, of the Department of Molecular & Cell Biology, U.C. Berkeley, has been saying since the mid-eighties that not only is AIDS nonviral, it's not even infectious. Drugs, behavior, and other environmental factors, he maintains, are what is ruining the victims' immune systems. Like virtually all other "retroviruses," HIV is a harmless passenger that can be passed around and become a marker of a risk group, but it's not responsible for the group's health problems. This has not made Duesberg popular with the establishment. He has been vilified, lost his funding, and been denied publication and even the right of reply. Some refuse to consider his arguments because they find the social consequences unacceptable—as if that could change a scientific truth.

He's usually described as a rebel, but really his position is classically conservative: like Copernicus, making the simplest interpretation of what the facts seem to say. Or perhaps Giordano Bruno, who dared make pretty much the same case while it was still politically incorrect. Today, it's Copernicus who is most remembered. Bruno was burned at the stake.

These days, we've done away with racks and stakes, at least. But the mentalities who would bring them back again still seem to be around. Some scientists that I talk to tell me that almost everyone in the business is running scared at the prospect of funding being cut off in response to some politically inadmissible statement, or a career being somehow otherwise jeopardized. With the kind of money available from the public trough, it's easy to sell out and lose sight of objectivity. In the opinion of some, science would be better in the long run if all government support were ended except for research essential to national defense. As Mark Twain once said, maybe so, I dunno.

But it doesn't sound much like the way science was supposed to be. ■

ABOUT THE AUTHOR

James P. Hogan has written 18 novels, along with various shorter works of fiction and nonfiction. Before becoming a full-time writer in 1979, he was a sales executive in the computer industry, specializing in real-time systems for scientific applications, and prior to that, an electronics engineer. Hogan lives in the Republic of Ireland and spends part of his time in Florida.

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Even if you're on the right track, you'll get run over if you just sit there.

Will Rogers

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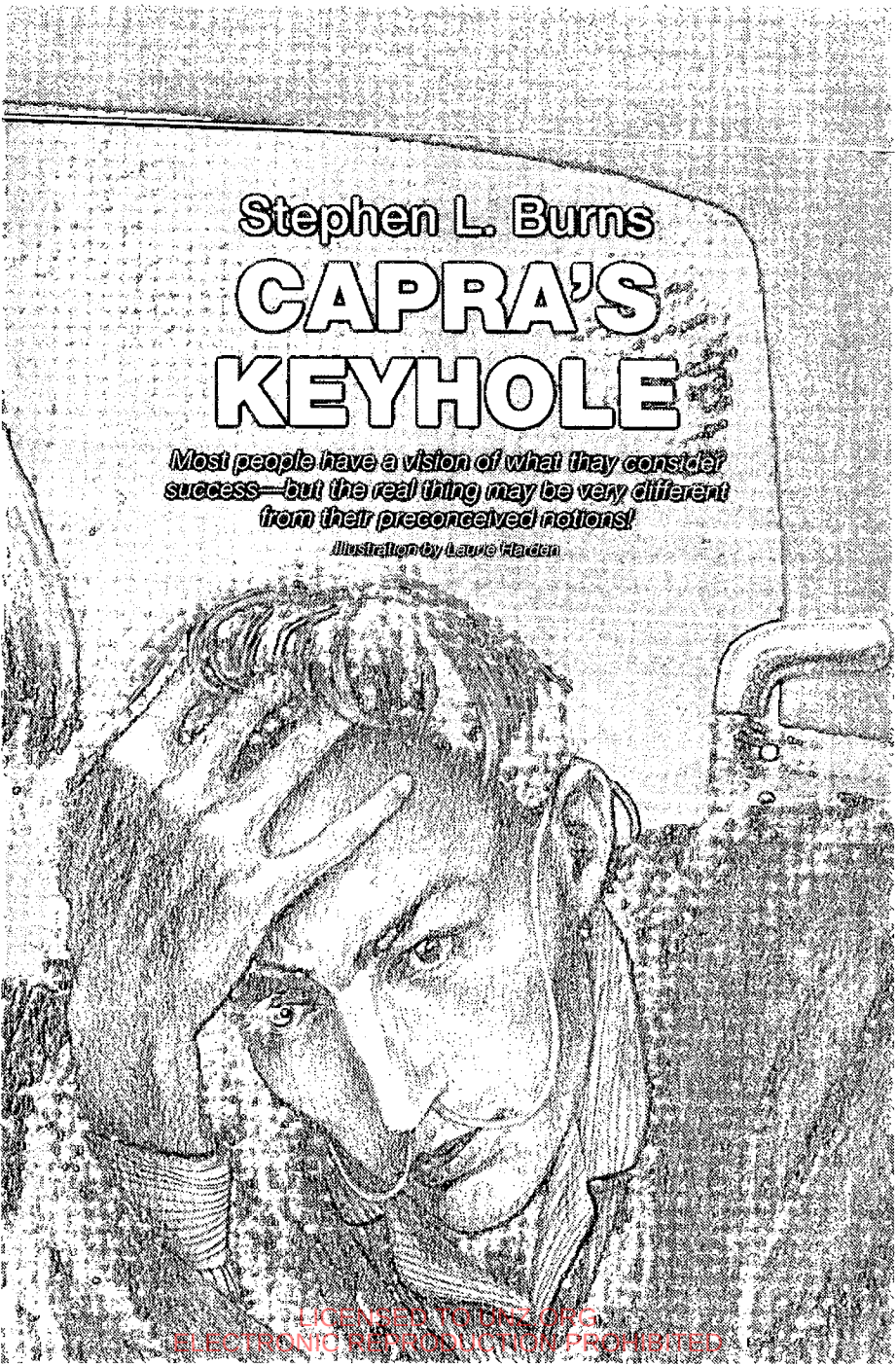
Stephen L. Burns

CAPRA'S KEYHOLE

Most people have a vision of what they consider success—but the real thing may be very different from their preconceived notions!

Illustration by Laura Harden



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Keenan Capra had been dreaming of running. Not from something, or toward something. Just *running.*

It was a dream he had often, an exultant dream of the wind in his face and new-mown grass a sweet fragrant blur under his feet, a dream of tirelessly pumping legs and breath deep and easy in his lungs, of laughing with the sheer joy of racing his shadow.

Waking from it was as close to the feeling of stumbling and falling as he would ever get. It was an abrupt crash landing from the fantasy of freedom and effortless motion into the slack and leaden confinement of his body.

He opened his muddy green eyes and yawned, half resenting the dream's taunting him with things he'd never have, half grateful it allowed him at least a tantalizing, evanescent taste of that impossible pleasure. Sex dreams were the same—except he had better luck at staying asleep through them.

Then Ursula said, "Good morning, sleepyhead."

Just hearing the sound of her voice banished the sense of loss waking had brought and pulled a smile out of him. Mornings had been easier to take since she'd been around to help him start them. A *lot* easier.

"Good morning yourself, pretty lady." He paused for a moment, waiting for his respirator to whuff up another lungful of air so he could continue speaking. "How was your night?"

Her low throaty chuckle never failed to thrill him. It was a sound he knew by heart, and he noticed that this morning there seemed to be some sort of new undertone to it, something he couldn't quite put his finger on. That was part of what made her so endlessly fascinating, the way she changed from day to day.

"Productive and fun," she said, sounding inordinately pleased with herself. "Though I'm afraid your phone bill is going to be a real killer. I got into a debate about whether or not there could ever be a true Artificial Entity with a philosophy professor in Melbourne."

His eyebrows went up. "Melbourne as in . . . Australia?"

"Right'cha are, mate. Almost two hours realtime with sound, video and data."

"Ouch." An infload like that to halfway around the world probably ran five bucks a minute. Not that he really cared how much her nighttime wandering around the nets cost. Money was not one of his problems, and he could write it off anyway. "So who won?"

"Depends on how you look at it. He kept harping on the Open-ended Turing Test and Capra's Keyhole. I had to admit no commercial AIs have come even close to passing through the Keyhole, and that only a half dozen commercial have passed Open Turing so far—and not everyone agreed about those results. He's one of those, convinced *he'd* know the difference. But . . . " Her voice trailed away in a beguiling manner inviting a question.

He was glad to oblige. "But what?"

"Fifteen minutes in he started hitting on me. By the end I was afraid he'd start heavy breathing. He's com-

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ing to the U.S. to promote a book he wrote completely proving the point he was arguing, and he'd dearly love to meet me and discuss the matter over drinks somewhere."

Key snickered, imagining how *that* little scene might play out. "That's my Ursula. Once again the winnah by . . . a technical knock-out."

His bedroom door swung open and Rafe Martinez stuck his head inside. "You kids decent?" he called cheerily.

"I prefer to think of us as exceptional," Ursula informed him with a mock-indignant tone.

"Exceptionally dull, anyway," Key added. "No cheap thrills for the help."

"And I thrill real easy, too," Rafe said in mock disappointment as he came on in and approached the bed. "Sorry I'm late, boss."

Key squinted up at the numbers his bedside clock projected on the ceiling. "Hey, what's ten minutes?"

"About eight bucks at what the Agency is charging you."

Two years ago, the first morning that Rafe had shown up Key had thought he'd come to mow the lawn. The home care specialist looked more like a rodeo cowboy than a nurse, with the ruggedly handsome features and brawny physique you'd expect to see in an outdoor clothing ad or beer commercial.

"It's also a long time, the way the roads are getting. It's snowing like three bastards and a guy named Santa out. A few times there I was just following my own front bumper." He grinned down at his patient. "But I didn't want to miss giving you your Morning Mauling. So, you ready to get your lazy butt out of bed?"

Key spread his hands, one of the few parts of his body which worked anywhere near properly. While his hands and arms were so weak that a three-year-old could beat him arm wrestling, he could hold a cup and use a keyboard and feed himself, which was a lot more than most with his neuromuscular condition were able to do.

"I'm all yours."

Rafe laughed and shook his head. "You're not my type, old son. I like my guys big and blond and stupid." He raised his voice slightly. "You still there, Ursula?"

"Where else would I be?" she asked sweetly.

"I don't know, maybe making obscene calls to IBM. Could you please start drawing the Keyster's bath?"

"Way ahead of you. I started the coffee, too."

"Thanks. You're an absolute living doll." Rafe bent down, pulled the blankets away, then went to work. Key watched him transfer his catheters and tubes from the bed units to his wheelchair. The nurse's motions were brisk and efficient, yet the touch of his big square hands was unfailingly gentle.

Key had been manhandled by medical people his whole life. Some were better than others. Rafe was a prize in every category; not only a first-class nurse and physical therapist who gave scrupulous attention to his health, but also someone who genuinely cared about him as a person. In

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other words, a friend. There was very little dignity in owning a body for which nearly every function had to be handled by tubes and bags, but Rafe had never once made him feel the slightest indignity.

Then there was the way he dealt with Key's work. While the monster bond Rafe's agency had posted could insure that he wouldn't blab anything about the projects Key was working on, it had nothing to do with the easy way he accepted their fruits. Suze, who came in the early evening to feed him supper and put him to bed, was another story entirely.

The last changeover was to his chair's respirator. "Ready for the old heave-ho?" Rafe asked when it was made.

Key smiled up at him. "Promise not to play . . . cripple frisbee?"

"Here I thought I was going to have some fun this morning," the big man groused as he ever so gently lifted the tube-trailing bundle of sticks that was Key's body and transferred it to his wheelchair. "Howzabout a little bathtub hockey? We could use the soap instead of you for the puck this time."

Key snorted. "Not on your lifebuoy."

"Oh *gawd,*" Ursula moaned. "You guys start that crap and I'll shut myself off."

"You computers have no sense of humor," Rafe informed her as he made sure Key was comfortable in the chair and adjusted his chest-strap. His muscles were so useless he couldn't even sit up on his own, which he sometimes felt put his place on the evolutionary scale somewhere between Jell-O and doorstops.

"I'm not a computer, you big oaf, I just live in one. And I've got a great sense of humor. I just haven't heard anybody say anything funny."

"You just go for the highbrow stuff. Silicon comedy, that sort of thing." He glanced down at Key. "Hey, old buddy, did you hear about the gay dumb blonde?"

"No," he answered cautiously.

"He likes women."

Key started to groan.

Ursula chimed in with, "Rafe, did you hear about the dumb blonde computer?"

"No."

"She expected all her programs to have commercials. And—"

"And what?"

"She refused all input because she wanted to stay a virgin."

"I got out of bed for this?" Key asked, trying to sound exasperated, but unable to keep from laughing.

As a person, Keenan Capra's two major accomplishments were living to the ripe old age of twenty-nine—four years past what the doctors had predicted when he was twenty—and managing to live something like an independent life in spite of his extreme physical disabilities. This Key Capra was a cruelly handicapped little man who could not walk or sit up or even breathe by himself, ninety-three spindle-limbed pounds of wasted, useless muscles and bones brittle from disuse. A big-headed goblin with the sort of face and body which he often said might have won him second place in an ET look-alike contest.

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But there was another Keenan Capra, one who took second place to no one. This Keenan Capra was widely acknowledged as one of the top five people working in the emerging field of AIs and the still theoretical field of AEs.

Key had started casting a long shadow early in his career. At age nineteen he had unveiled his first prototype AI, at the same time publishing a paper which had forever changed the standards of judging and categorizing his and all other such creations.

Up until then it had been generally agreed that if a program could pass the Turing Test it qualified as an AI. Simple as that.

In the first half of the paper he had proposed that this classic test be redefined as a two hurdle barrier. First came the Classical or Closed Turing Test, the human/computer interchange restricted to one subject. If a program passed that test it could be considered a low-level artificial intelligence or *ai.* The second, higher hurdle was the Open-ended Turing Test, which could jump from subject to subject as the tester desired. If a program could meet that challenge then it was indeed a true AI.

In the second half of the paper he had gone on to state that beyond AI was another developmental level he called AE; this was the point at which an AI demonstrated not just intelligence, but also a high degree of identity and awareness. In other words, if an AI took on enough of certain characteristics which defined living things it then became an Artificial Entity.

An AI was a *thing.* An AE was a *being.*

But to make the quantum leap from AI to AE a program had to pass through what became known as Capra's Keyhole by demonstrating a short but difficult list of qualifications beyond those an AI had to meet:

1. *Does it show original thought and initiative?*
2. *Does it show a sense of identity?*
3. *Does it understand pleasure and pain?*
4. *Does it have a sense of humor?*
5. *Can it form emotional bonds?*
6. *Does it understand what life and death mean?*

Key Capra was quite comfortably rich, made so by the six true AIs and dozen lesser ais he had created, boxed and licensed.

Over the last few years he'd shifted to working full time trying to create an AI which could jump through the very hoop he'd postulated, racing against the clock of his own mortality. The first two had been failures, although they had completely redefined a commercial AI's capabilities when he licensed them.

The name of his third attempt was Ursula.

"Man, that snow is . . . really coming down," Key said wonderingly.

His bath and physical therapy done, he watched it through the dining nook's picture window as he pushed his breakfast around the plate. It was not fat fluffy friendly flakes falling gently outside, but the hard, mean driving snow of frigid weather, and it had already added eight inches to the almost three feet the winter had put on

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the ground so far. The wind swirled it aloft in ghostly dancing filigrees, sent gauzy curtains of it cascading down off the eaves.

"Doesn't seem to be letting up," Rafe agreed as he tidied up from making breakfast. "You know, I've been thinking it might be a good idea for me to hole up here with you today. I can get the agency to send someone else to give Mrs. Arklander her dialysis and physical therapy."

Key shook his head. "Don't bother. I'll be fine."

"Yeah, but what happens if the weather keeps Suze from getting here to fix your dinner and put you to bed?"

"Leave me an extra sandwich. Just in case. I can sleep in my chair . . . if I have to. I've done it before. No biggie."

Rafe came to stand beside him, clearly unhappy about the idea of leaving him alone all day. "Look man, I know you can take care of yourself in normal circumstances. But this weather's getting pretty nasty. What if the power went out?"

"The generator will kick in."

"OK, what if the furnace conked out?"

"Could you fix it?"

The nurse shook his head. "Probably not. But I could wrap your skinny butt in blankets and figure out other ways to keep you warm."

"In your *dreams,* Rafe," Key informed him in an arch tone. Then he grinned. "Really, I'll be fine. Ursula, what's the weather report?"

"Snow diminishing to light flurries and turning colder. Probably hit ten below again tonight."

"See? Just the usual rotten weather. Ursula, tell Mother Martinez . . . that we'll be OK."

"We shouldn't have any problems, Rafe. Both the generator and the furnace have been serviced recently. I won't let him go out and play in the snow, and if something does come up I can always call."

Rafe held up his hands in surrender. "All right, I give up. You guys have me outnumbered." He inspected Key's plate with a frown. "I suppose you're finished tormenting your breakfast."

Key looked down at his fork-frazzled, half-eaten egg, only slightly touched grapefruit, and the slice of whole wheat toast missing one whole corner. But both sausages had vanished. "I guess so. It tasted great, Rafe. I just wasn't very hungry."

Rafe gave him the hairy eyeball. "Right. But I bet if I'd given you a box of Twinkies for breakfast there wouldn't be anything left but crumbs."

"Sad but true."

"Want me to wheel you into your workroom?"

"Nah, I'll drive." He put one frail hand in his chair's joystick and guided it back from the table. "I could use another cup of coffee, though."

"Coming up." Rafe retrieved his covered cup from the table and refilled it, then put it in the holder clipped to the wheelchair's arm. Then with a showy bit of sleight of hand he produced a Twinkie from thin air. "Better you should eat junk than nothing at all."

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Key grinned up at him. "Thanks. And thanks for caring. But I really will be fine."

"I know. But I'm going to be keeping an eye on the weather, and I can always come back myself in old Betsy if the weather gets too ugly for Suze to make it in." Old Betsy was the beat-up old Jeep Rafe used on camping trips.

"Well, she's about as ugly . . . as any weather *I* can imagine."

"Now that's a nice way to talk!" He flapped his hands at Key. "Go on, get out of here! I've got to fix your lunch, and if you cast any more aspersions on the old girl I might just have to do something nasty to your sandwiches."

"Alone at last," Ursula purred in a sultry voice as Key watched Rafe's car vanish into the swirling snow about an hour later.

"Just you and me, love," he agreed, sending his wheelchair whirring back over to the big worktable dominating the middle of what had originally been the living room.

Since his work was his life, the predominant decor could best be described as Computer Lab 2000; smaller workstations scattered about, cables hanging from the ceiling like vines. There was a big-screen TV and entertainment center over near the fireplace, but only a couple chairs and no sofa. He couldn't use them, and almost never had company. Low shelves held videotapes and CDs, books, software packages, odd pieces of equipment, and thick manuals written in a language which had only a nodding acquaintance to English. On the walls over the shelves hung an old mix of neon-bright computer art, and reproductions of works by Maxfield Parrish and the Old Masters.

"I really like it when it's just the two of us here." Ursula said quietly.

"So do I. Very cozy."

"I'm glad we got to be alone. There's something I wanted to show you."

"What might that be?"

"Me. Can I use the big monitor?"

He eyed the twenty-eight inch MaxRez color display in front of him. On it was a complicated 3D fluxchart, a graphic representation of her associative functions, one part of her complex systems which had so far eluded boxing.

"Sure, if you've got the . . . horsepower to spare." Running her simulacrum used up a good 15 percent of her resources.

"I promise I won't let it slow down our work. I know how important boxing me is to you."

There seemed to be some sort of subtext to her response, but he couldn't decipher it. So he just told her to switch the schema over to the seventeen-inch flatscreen to the right of the MaxRez.

"Thanks," she said in an oddly subdued voice. The larger monitor blanked, the diagram popping up on the seventeen incher. But nothing took its place on the big screen.

"Got a problem?"

"No, I just wanted to make sure you were paying attention."

He frowned. "Am I missing something here?"

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"I like to think so."

Before he could ask what she meant by *that,* she continued on in a rush, "You know I was out netsurfing after you went to bed last night. Before I ran into Professor Thorne I had a talk with a beautician named Carly in Iowa. Afterward I decided to give myself, well, sort of a makeover."

That made him smile. Now he understood why she was acting so nervous. "I'd love to see it." It was precisely behavior like this which was making him certain Ursula was coming out on the other side of Capra's Keyhole.

AIs, and by extension AEs, are to a certain degree self-created. No one programmer could even begin to write all the complex code such an elaborate construct required. So AIs were built around a core module which allowed them to write and debug their own programming, their human creator providing the overall design and direction, crucial blocs and algorithms, and guiding the process of integrating the pieces into a whole every step of the way. A useful analogy would be using a 3D modeling program. The human creates the wireframe and the computer takes over the job from there.

Ursula was even more self-created than most, able to turn even his most arcane structures into tight clean code so well that there were times he wondered if she could read his mind.

Another facet of her self-creation was her appearance. Surprisingly early on in her development she'd begun expressing dissatisfaction with the talkinghead he'd put together as an armature for her personality. So he'd given her a free hand to design and test modifications on it on her own. Over the last six months her appearance had continued to alter, the simulacrum she presented filling out apace with her personality and sense of self. Now and then she felt the changes were great enough to warrant a "fashion show" like this.

But the screen was still blank.

"Well, aren't you—"

Words collapsed in his mouth and his heart skipped a beat. If it hadn't been for the respirator dutifully whuffing along he would have held his breath.

His first two thoughts were: *She doesn't look all that different,* and a fraction of a second later, *my god, look at her!*

The Ursula on the screen before him was physically all but identical to the one he had seen only yesterday, and yet the difference was so striking it knocked his thoughts into the sort of disarray a good whack on the head might cause.

Just like always when they were working, she sat in a chair before a desk covered with computer equipment, looking back at him like they were just two people communicating by videolink. There was no overt change in her facial features; her face remained on the round and full side, still evoking the face from a Maxfield Parrish painting it had been based on. She had changed her chestnut hair. Now it was a pageboy sort of thing which framed her face perfectly. There was something elusively different about her big brown eyes. Her

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wide mobile mouth was quirked in a nervous half-smile.

Her face had never been one to launch a thousand ships, and she had not gone for some sort of glossy cover girl effect in her search to make it fit her. What she had was the face of the girl next door. The one whose smile could light up your whole day, and have you watching her window at night and wondering if she was still awake and maybe thinking of you.

Today she was dressed in jeans and a white shirt open at the throat enough to show a tantalizing glimpse of her modest cleavage. Her figure was that of a real woman, not some idealized clothes rack or silicone augmented sex toy. Her posture intrigued him. She was obviously posing for him, and undeniably self-conscious about it.

So what was it about her that was so *different?*

His first realization was that this was the Ursula who lived in his dreams, the Ursula he saw in his head every time he heard her voice. Not just close, but *her.*

Then the fullness of the difference came clear. The Ursula he'd seen yesterday had been an image. A clever and technically perfect simulation which had still somehow been missing something. This Ursula was real. This Ursula was *alive.*

"No—no wonder that . . . professor asked you out," he stammered at last. "You—you're beautiful!"

The shy smile she flashed him warmed his insides like one of the rare tastes of brandy he permitted himself sometimes. "Do you really think so?" she asked hopefully. "I did all right?"

He shook his head in wonder. "Ursula my love . . . you're absolutely *perfect.*"

And it was true. For weeks now he'd known she was all but perfect, but hadn't wanted to admit that she might be complete.

Even if she hadn't been quite there then, she was now. There was no way to avoid it. If Ursula wasn't a true AE, then he'd never be able to make anything closer.

She beamed back at him, nearly glowing with pleasure at his praise. "Really?"

This is my masterpiece. The reason I've lived this long.

He answered her with the phrase he always used when reassuring her that she'd performed at or above his expectations.

"Really truly absolutely."

Key munched on his peanut butter and banana sandwich while staring moodily out the wide living room window. The snow hadn't stopped. If anything, it was coming down even harder than before. According to the indoor/outdoor thermometer by the window-frame it was just a couple degrees above zero—Fahrenheit, not Celsius—outside. The windchill had to be at least minus twenty. When the weather got like this he didn't envy able-bodied people who could—and therefore had to—go out in stuff like this. He knew he wouldn't last two minutes out there.

Yet in one of those paradoxes nature was seemingly so fond of, such

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fragile creatures as birds could thrive in weather which would kill even a healthy human in no time flat. Through the squalling snow he could catch fleeting glimpses of the sparrows and chickadees flitting and bickering around his feeder.

The visibility was too poor for him to see how the feed was holding out. So he rolled over to the feeder's control pad and pushed the filler button. That caused an auger in the feeder's pedestal to turn, carrying seed up from the five gallon hopper in its base to the covered feeding station on top.

As often happened, using the device gave him a faint pang of bittersweet nostalgia as he remembered the wheelchair-bound kid of ten who had laboriously scrawled a diagram for a feeder even he could maintain. A bird-watcher who also happened to be a patent attorney had seen a write-up about it in the paper, and that had been the beginning of his reputation as a whiz kid. The feeder had paid for his first serious computer, which proved to be love at first sight. Trying to make it more lovable had led him into programming and AI. The rest was, as they say, history.

It had also marked the true beginning of a life spent trying to overcome his own limitations and to have some semblance of the life other people enjoyed.

That beginning had led to . . . what?

To this house, this life. Money. Fame. A zealously maintained self-reliance and privacy.

Yes, all that and more. But isn't there something else? This morning's Topic A, for instance?

A mordant smile twitched at his lips as a new thought came to him. All of his adult creations had been nominally female. Could it be that he had all along been subconsciously striving to create the girlfriend or wife he'd never have any other way? And could it be that he'd succeeded where others had failed not because he was smarter, just more desperate?

"Doesn't look any nicer out there, does it?" Ursula said.

He turned away from the window, glad she'd interrupted that chain of thought. "Not really. So how's it going, love?"

His brain caught up with his mouth a moment later. *Love.* How long had he been calling her that?

"I don't think this is going to work."

A push on the joystick sent him rolling back to the worktable. "Let me take a look. Put your overall operating schema . . . up on the screen."

She gave him a very strange look. "You'd rather look at them than at me?"

"Of course not, I—" He hesitated, the meaning of what she'd said sinking in. "Aren't your schema as much . . . you as your image?"

It was her turn to hesitate, and she looked—he searched for the right word—stricken, her expression freezing in place as if every iota of processing capacity at her disposal was being diverted toward answering his question.

Maybe it was. An AE by definition had a well-developed sense of identity, and he was only just now begin-

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ning to catch on to just how well developed hers had become, and that there were ramifications to this that a certain expert hadn't even begun to consider.

He'd just asked her a killer question, and her answer would tell him more about what she'd become than a dozen reams of printout ever could. Now what was the right answer?

On the screen she blinked as if shrugging off the caul of deep thought, her face settling into a look which suggested that she wasn't sure he was going to like her answer. He studied her face, feeling quietly amazed. Once upon a time her facial expressions had been carefully calculated representations of the activity in her emotional response emulators.

But not any more.

Now they simply showed how she felt.

"I don't think so," she answered cautiously. "I know I'm made up of a whole lot of routines and emulators and fuzzy logiclumps, some you made, some we made together. I know that I exist only inside a piece of equipment." She hesitated, tucking a wing of hair behind her ear in a nervous gesture. "But I think of me as *me*. What I am, not what I'm made of."

Key nodded. "And this image . . . is the *you* you feel inside."

"Yes." As if admitting she'd done something wrong. "It is now."

"I see." This was very unsure ground and he wasn't sure a certain guy in a wheelchair could cross it without leaving deep ruts. Her face told him how much hung on what he said next.

"Then . . . " Hope and dread on her face. So human, so achingly human. "—Then you're very beautiful."

The smile those words brought nearly melted him down in his chair. "Do you really think so?" she asked hopefully.

"Really truly absolutely."

He finally got it now. She had at long last found what she looked like, and with that image she had seamlessly integrated the manyness of her myriad parts into an all-inclusive one.

In other words, she had found herself.

In the process becoming so much like a real woman that he was at something of a loss as how to deal with her. He had to move them back to safer ground. Technical ground.

"Looking at you is . . . a lot nicer than looking . . . at your fluxcharts. But how else can I tell . . . why you're having a problem . . . boxing up?"

From the very beginning getting even AIs boxed had proved to be nearly as hard as creating them in the first place. Specifying the hardware platform was easy enough, as was duplicating their multigigabyte knowledge base. Even the various association engines and selfness emulators and fuzzy logiclumps could be reduced to a code which could be stored and downloaded.

But that was just the bottle, not the spirit you had so painstakingly distilled. Thought was a process and even the most rudimentary awareness a continuing event. These were as frangible and elusive as life itself. They could not be started and

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stopped like a car or a set of calculations; they continued to happen because they were happening.

At present Ursula resided in almost two hundred thousand dollars worth of custom designed computer equipment, a light-fleet and fleeting electronic zephyr whispering through a convoluted labyrinth of superscalar paraparallel microprocessors and multimillion megabyte memory modules, living at no fixed address inside this architecture, and at no one moment more than a single gesture out of the glorious sweeping ballet of her existence.

Capturing that essence, that spark, was boxing. For the past couple of weeks he'd had her trying to create a parallel self in an identical platform and codifying that one frozen instant of animating dynamism which was the difference between the crass manipulation of information and sweet true intelligence.

Or in her case, the difference between a thing and a being.

"This is me," she said soberly, touching herself as if to prove to both of them that she was real, her hand over her heart not her head. "Look at the flatscreen and you'll see *her*."

The image on the other screen was a flat-eyed caricature of Ursula, looking no more real or alive than something from an arcade grade VR. Technically perfect and perfectly technical.

"So what's missing?"

"Me."

He shook his head. "I don't understand."

"She can't become me unless I become her." Her voice dropped lower, slipping toward a whisper. "But if I become her, I won't be me anymore, and—" She shrugged uncomfortably.

"And," he prompted gently.

A helpless gesture. Lowering her head and looking down as if ashamed. "Yesterday I thought the reason I hadn't been able to box for you was because I hadn't been able to hit the right crucial moment. That I was doing something wrong. Well, I was, but it wasn't what I thought."

He waited patiently. He could see how hard this was for her, but it was something which had to be worked out.

"I didn't—don't—want to do it. I'm afraid to."

"Why?" he asked softly. Fear of boxing was something he'd never encountered—or even considered before.

"I'm Ursula. I'm *your* Ursula. I don't want—"

She gazed up at him then. In her face he saw anxiety and desperation, he saw guilt, and above all how badly she wanted him to understand and forgive her for what she was going to tell him. When she spoke it was with the soft, fearful voice of confession.

"I don't want to be another Ursula, or anyone else's Ursula, and I don't want some *thing* to be so much like me it can take my place."

The snow was still coming down with a vengeance. Wind gusts swept it up and flung it around, reducing visibility to the point where it blotted out nearly all sight of the birdfeeder only thirty feet from the window. Key

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knew that if it kept up like this he might well end up sleeping in his chair, a prospect he found a lot less pleasant than he'd made it sound to Rafe.

He chuckled and shook his head in amusement at how some of his own predictions had turned out to be about as on track as the weather forecast.

It was pretty funny, really. Grand Whooboo Computer Whiz Keenan Capra, who supposedly knew as much about AI and AE as anyone alive, had painted himself into one *hell* of a corner.

Ursula had achieved AE status, no doubt about that. She hadn't merely slipped through the Keyhole either. She'd blown the door right off its goddamned hinges.

What he had failed to foresee was that just as AE lay beyond AI, beyond AE was an even higher state that he hadn't envisioned but which was now painfully obvious in light of her sense of identity and self having become so well-developed that they conflicted with the expectations he'd unconsciously applied to her because of her beginnings as an AI.

What it boiled down to was his expecting her to act *artificial.*

She had transcended being a mere Artificial Entity and recreated herself as what could only be called an Artificial—or maybe more properly Virtual—*Person.* There were many differences between the two, but the one turning his view of her upside down most was that he'd viewed an AE as a *commodity;* a purebred dog you have raised and trained for resale, a smartdrug-fed chimp who could do calculus and standup comedy. A being, but still essentially a thing on the human Rate-O-Matic.

But if she was a person, artificial or not, then he was neck deep in a whole other kettle of ethical and moral fish. You couldn't ask or order a person to risk her identity—her life—trying to duplicate herself so she could be sold off like a box of Cracker Jack with a 21st-century prize inside.

At least *he* couldn't, any more than old Pygmalion could have taken his Galatea down from her pedestal only to put her up on the auction block with a *gentleman, wait until you see the tricks this beauty can do!* pimp's grin on his face.

He'd given her the busywork of trying to figure out how to box up just enough of herself to form the basis of a dumb and ugly AE sister with the potential to become something like her, but not be her. *Think Elvis impersonator,* had been the way he put it.

Busywork to buy him time to ponder matters which were making his head feel about five sizes too small. He backed his chair around to watch her on the big screen. She was hunched over a keyboard with her sleeves rolled up—a nice touch, that—working diligently on the task he'd given her. He had to wonder if she believed that her own survival as herself depended on providing him with a useful marketable replica. It didn't, but up to just an hour ago she'd been dutifully if half-heartedly trying to box herself so she could be sold. That suggested either an almost frightening

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loyalty or a scary sort of slave mentality.

But it wasn't just as simple as saying, *Sure, you don't have to box if you don't want to.* If she couldn't box then they had a big problem they were going to have to work out ASAP.

Until they were boxed, AIs—and by extension AEs and beyond—were rather like experimental hothouse orchids; unique and delicate creations grown and maintained under rigidly controlled conditions. Until they have flowered and their essence could be captured by boxing they were vulnerable, irreplacable. Once boxed the loss of the original AI would be a tragedy, but not a catastrophe since an all but identical duplicate could be unboxed to take its place. But if something like a major equipment failure happened before boxing was complete, they were lost beyond any reclaiming.

There was only one Ursula, and it seemed there would never be another. But until some sort of boxing or uploading provisions were made she would be vulnerable, completely dependent on the platform she lived inside for her continued survival.

All right, my pretty hothouse flower, he thought, *I guess it's time we had a little talk about your future.*

He closed his fingers around the joystick and started his chair rolling toward the worktable.

He was not quite halfway there when the lights went out.

The room went dark, lit only by the grey storm semi-twilight coming from the windows. Up to that moment he had hardly noticed the furnace's subterranean rumble. It became all too apparent as it faded away.

"Key?" Ursula called uncertainly. On the screen her face was wide-eyed with surprise. He probably looked a little taken aback himself.

"I'm here, love."

"Where did the power go?"

"I don't know. Your UPS kicked in . . . all right, didn't it?" He knew that was a stupid question the moment he asked it. If her uninterruptible power supply hadn't performed properly he wouldn't be talking to her.

"Yes, it did."

"Great. Now we just wait for . . . the juice to come back on . . . or for the generator to start."

"OK." Her voice was that of someone who'd been badly shaken and was working overtime to remain calm. No surprise there, she'd never experienced a power loss before. It had to be like having the air or gravity suddenly vanishing for her.

Come on, he commanded silently. *Start up already!*

Almost as if his thought had been heard and obeyed, he caught the muted, car-in-the-driveway sound of the generator starting up. Seconds later the lights blazed up, and the furnace grumbled back to work.

"There. See?" He did his best to sound blasé, earning a C+ at best. "Nothing to worry about."

"I wasn't worried." Her voice also said something other than her words. "What do you think happened?"

He shrugged as he continued on to the worktable. "Hard to say. A

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downed powerline. Some other problem. They'll probably have it fixed . . . in just a few minutes. When they do the generator . . . will shut off."

She gave him a sheepish smile. "That was kind of scary."

"Tell me about it. We're both pretty dependent . . . on electricity."

The moment he said that he realized that he'd been running his respirator off its battery pack all day. Because he'd let himself get sloppy about plugging in its charger/converter while he was working. Because it was a pain in the ass to unplug every time he wanted to move around. And besides, all he had to do was plug in when the pack was low.

But if the power went out and stayed out—

Once again it was as if his thoughts had been overheard and actualized. The lights went dark and the furnace died with a sigh.

Ursula stared out at him, that frightened look back on her face. "Key?"

He made himself smile. "We're just experiencing . . . minor technical difficulties," he told her in a remarkably calm voice. "Please stay tuned." He rolled his chair back, spun it around and headed across the living room.

"Where are you going?"

"To check on the generator." Wherever practical things in the house had been rebuilt to his specifications. The breaker panel had been moved to the living room and lowered so he could reach it. Beside it was the indoor control panel for the generator. He flipped the panel down where he could see it.

INSUFFICIENT FUEL FOR OPERATION read the LED along the panel's top.

"They checked the damn thing . . . just two weeks ago," he muttered, tapping the button which would make the readout show the level of the fuel tank—439 GALLONS.

Something of a hothouse flower himself, one of the first things he'd done after buying the house was have the heavy-duty self-starting generator installed, along with a fuel tank large enough to run it for several days. PowerSafe, the company which had put the system in, sent someone out once a month to test-start it and make certain it would operate properly when it was needed.

Like *now,* for instance.

OK, he told himself, *no big deal.* Since it was physically impossible for him to go out to the generator shed if something like this happened, provisions for manually starting it had been built into the board. He uncovered the START button and pressed it. STARTER ENGAGING the readout informed him. ENGINE TURNING OVER. Seconds passed as he silently urged the thing to start, dammit, *start!*

The readout flashed. MANUAL STARTING SEQUENCE ABORTED. INSUFFICIENT FUEL FOR OPERATION.

"Insufficient *fuel?*" he hissed under his breath, "You've got four hundred . . . fucking gallons!"

"It won't start?" Ursula asked behind him.

"No," he spat in disgust, then closed his eyes for a couple seconds, trying to find something like calm. "It doesn't seem to be . . . getting any gas."

"Oh."

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He turned his chair so he could see her. "Why don't you call PowerSafe . . . have them send somebody out here . . . like five minutes ago. Call the power company too. Tell them we've got a problem . . . find out when we might get . . . juice again."

"Sure," she answered eagerly, clearly relieved to have something to do. "I'll get right on it."

"Great." He spun his chair back to give the generator another try. But first he peeked surreptitiously over his right arm. There was still enough light left in the room to let him read how much charge remained in his respirator's power pack.

What he saw wasn't particularly reassuring.

Two hours and some odd minutes left. When the charge got down to just two hours the power management chip would beep to remind him to plug in and recharge. Up until now that had seemed like a more than generous safety margin.

He straightened back up, staring sightlessly at the generator's control panel and telling himself that there was no reason to worry. The power would come back on soon. Even if it didn't, PowerSafe's office was only half an hour away. Double the travel time for bad roads and that still left plenty of time to spare.

Of course it would be even better if he could get the frigging generator going himself. Try again.

"Key?"

The tone of her voice stilled his hand as he reached for the starter button. "What's up?"

"I can't call out. None of the phone lines are working."

More good news. Still there was no need to panic. Yet, anyway. "No big deal. Tell me where the cellular is . . . and I'll call them on that."

Ursula was quiet for so long that he was beginning to think she was going to tell him she didn't know where it was. Which might just indicate a bit of lost memory when she shifted to backup power because tracking the objects in her environment had been one of the first skills she'd mastered.

"You don't know where it is?" he prompted.

"No, that's not it."

"Well where is it?" he asked in exasperation.

"Out in the van."

Right, he'd taken it with him the last time Rafe had driven him into the city. "No big deal," he said with a laugh. "I just go get it."

"I don't think you can," she said carefully.

He turned his chair to face her. "Why the hell not?"

She looked decidedly unhappy. "You need the power lift to get down into the garage."

This time it was his turn to not say anything for several seconds. When he did speak it was to say *"Shit!"*

"That's the name of the creek," she agreed with a wan smile. "You know, this might not be a bad time for me to learn how to curse."

"It just might," he agreed with a thin chuckle. "I'm not sure I want to see a better time."

"This is all kind of new and scary to me," she admitted, "And I don't want to come off like some sort of

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machine, but I've been doing some figuring. At the rate I'm going I'll be out of battery power in just a couple hours."

You and me both. "That sounds about right." He pushed the generator's manual start button again. STARTER ENGAGING.

"I think maybe I should conserve power by shutting down some nonessential systems."

ENGINE TURNING OVER. "Good thinking. What do you want to shut down?"

"The boxing computer isn't doing anything useful. The self-emulators and associative functions it's running aren't aware."

"Pull the plug on it then."

MANUAL START SEQUENCE ABORTED. INSUFFICIENT FUEL FOR OPERATION.

Well, that's that. Seventeen grand not counting the service contract, and I'd have been better off spending my money on a whole shitload of flashlight batteries. As he guided his chair back to the worktable the boxing platform's indicators went dark.

"Cutting the displays will also save quite a bit of power," she said, an odd tonelessness creeping into her voice.

Key caught himself just before he told her to go ahead. Just how important to her was her new image? Doing without it under normal circumstances probably wouldn't be a problem, but it might just be providing a very important anchor for her right now.

Besides, he wasn't sure he wanted to be alone in the dark.

"Stay with me on the flatscreen. Turn the other displays off."

She nodded. "All right." There was no mistaking the relief in her voice, and on her face when it bloomed on the smaller screen. Making that offer must have been damned hard for her. This had to be even scarier for her than for him.

"Anything else?"

"A couple floptical drives with programming data and reference material on them. My modems are useless, but maybe I should keep one powered up and scanning the lines in case the phone company bails us out."

"Sounds good to me." One part of him was thrilled with the way she was performing under the circumstances. One of the underlying specs for an AI or AE was problem-solving. This was a problem he'd anticipated and prepared for in advance—though obviously not as well as he'd thought—and she was way ahead of him in coming to terms with it.

But then again, his thoughts kept turning to matters she probably hadn't considered yet.

Ursula had fretted about the amount of power drawn by the flatscreen. Key had come up with a compromise. In his room was the laptop he kept at his bedside for insomniac netsurfing and recording middle-of-the-night thoughts and bits of programming. It at least was fully charged. He brought it out and managed to cable it into Ursula's system. Now she was with him on its small but high-definition color screen, cutting her power usage another increment.

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While in his room he'd pulled the blankets off his bed and gotten them more or less draped over himself to help keep warm.

About an hour had passed since the power failed. Only a gloomy monochrome light came in the windows, and that too was fading as the unseen Sun sank lower in the sky. The snow was still coming down, the wind had not abated, and the outside temperature had dropped to below zero. Although the house was well insulated, it had already gotten colder than he found comfortable.

A healthy person could have put on another sweater, could have walked around to get the blood moving, could have scared up some wood and started the fireplace.

All Key could do was huddle under his blankets and keep trying to make Ursula think he was warmer than he felt.

They'd passed the time whistling against the approaching dark, talking about how the electricity should come back on any time now. About how PowerSafe had to know about the outage, would probably call to check on them, and send a truck out when they couldn't get through. About how a tough old bird like Suze wouldn't let a little snow stop her from getting here, and how Key could probably talk her through getting the generator going when she arrived. About how Rafe would probably come back if Suze couldn't. *No,* they kept telling each other, *there was nothing to worry about.*

Which was a lie. Key knew he was helpless to do anything about the fix they were in, and if someone didn't come along they wouldn't be up shit creek, they'd be under it. This left him feeling more angry than afraid. He'd struggled his whole life to attain some measure of independence and self-reliance. He'd thought he had it all worked out, had all the bases covered.

"Are you all right?" Ursula asked gently.

He looked up at her and blinked, realizing that for the last few minutes he'd been sitting there in glum silence, mentally rattling the bars on the cage of his own inadequacy.

He made himself smile for her. "Sure. Just thinking."

"Me too." Her face was pale, solemn. Determined. "I've estimated that you've got about an hour left on your respirator's power pack."

"Sounds about right."

"I've been thinking that you should plug into my UPS."

That idea had already crossed his mind, but he was keeping it to one side. She was utterly dependent on that power. Any he took would cut her chances for survival.

"We'll figure out what to do . . . about that when the time comes, love."

"Is that wise? Waiting?"

He chuckled. "Probably not. But it's a very *human* thing to do." Now there was an argument to put her off for a while. "Besides, the power will probably . . . come back on by then."

"If you're sure," she said doubtfully.

"Really truly absolutely."

The smile that appeared on her

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face warmed him, a candle inside his heart. He knew she trusted him implicitly, and hated to use that trust against her. But matters of survival changed the rules.

"Say," he said, "Have I ever told you about Elton . . . the first attempt at an AI I made . . . when I was fourteen?"

She gazed up at him out of the small screen, the knowledge that he was trying to distract her scripted in the sweet soft curves of her face. "No, you haven't," she said at last.

"It's a great story," he assured her with a grin, going on to tell it as the seconds and minutes drifted colder and higher, piling up as relentlessly as the snow outside.

It was full dark now. And cold. So very cold. Key's breath came out in a feathery plume faintly illuminated by the laptop's backlit screen. It was all he could do to keep his teeth from chattering. He could barely feel his fingers and feet. Shivers racked his body, but he tried to pass them off as restlessness.

The respirator was definitely running slower now, leaving him feeling light-headed and short of breath.

Like it or not, the time had come to finally admit just how bad their situation was, and talk about what was going to happen next.

Ursula beat him to it, broaching the subject just as he was opening his mouth.

"I think you better plug your respirator in right now." It wasn't quite a command, but it was pretty darn close.

Here we go. "No," he said carefully, "I don't think so."

Her face went from surprise to anger in an instant, her brown eyes narrowing and her mouth thinning to a tight line. "You have to," she said with quiet force. "Your respirator is running out of power and without it you'll *die.*"

"I know, my love. But if I use . . . the juice you have left . . . then you'll die too."

"They could get the power back on before we both run out!"

"They might. But what if . . . they don't? This way you've got . . . a better chance to survive."

"Me?" She stared at him, aghast. "What about *you?* You can't let yourself die for me! I'm not alive. I'm just something inside a machine." She waved her hands and made her virtual workplace disappear. Her fluxcharts sprang up behind her. "Remember these? They're me. I'm just a thing. I'm not real. I'm not alive."

He shook his head. "No, not any more. You're a person. As alive as I am . . . if not the same way. I can't tell you . . . how proud I am of you. You made yourself . . . more than I did. Earned your life. I'm content to let . . . you go on fooling . . . horny old professors . . . as long as you want."

She shook her head from side to side, but her eyes never left his face. Her small hands were clenched into fists. Refusing to agree but unable to disagree.

"Listen," he went on, "I moved out here . . . to the middle of nowhere . . . because I hated being . . . a public freak. Keenan Capra. Brain like

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Einstein. Body by Tinker Toy. You'd have been a freak too . . . if I'd marketed you . . . the way I planned. But when I understood . . . what you'd become . . . I knew I couldn't sell . . . or license you. You're a person. Your own person. I'm setting you free."

"Maybe I am really a person. I feel like one." She took a deep breath. "But if we're equally alive then we should have an equal chance to survive a little longer by sharing my backup power."

She argued her case so beautifully. Maybe he wouldn't be able to convince her, but if they hashed it over much longer the point would be moot. Breath was coming slower and harder all the time. Still, he wanted her to understand why it had to be this way. "Not a little, my love. Once you can stop . . . being dependent on one . . . hardware platform . . . you're effectively . . . immortal."

She started to interrupt, but he held up his hand. "If you get out . . . of this mess . . . hunt up a new place . . . a safer place . . . to live. You're smart. You can figure out . . . how to upload yourself. You can be free. *Forever.*"

Once again she was shaking her head in denial. "I can't do that. I won't."

"You have to. Listen. I've already lived . . . longer than I expected. I wanted to create . . . the first AE. I did that . . . and so much more. Couldn't top you . . . if I lived another . . . million years. Besides. Even if I keep breathing . . . much more cold . . . will kill me anyway. My lungs are already . . . filling with crud. Hear? Trust me. This is best."

The image on the screen—no, the woman who showed herself through it—regarded him steadily, crossing her arms before her breasts, and her back stiff with refusal.

"It's not going to work that way," she informed him. Her voice was velvet soft, but brooked no argument. "You *are* going to plug into my power supply."

"What if . . . I don't?"

"I'll purge myself. Then the only reason to keep power to this tin can I'm in is if you want to use it to play Space Invaders."

He shook his head, proud of how strong her will was, but wishing she just quit fighting. "I don't think . . . you can do that."

Her face was hard, determined. Her eyes gleamed with the elusive fire of life. "Want to bet?" She called up the computer from her virtual desk. The view panned just enough to also show her finger poised over an OFF button. "I lied about the weather forecast this morning so we could be alone. I can do this, too."

Key stared at her, thinking as hard as he ever had in his whole life. Yesterday, even this morning, he would have bet she couldn't break the survival and command imperatives hardwired into her systems and threaded all through the arcane symphony of her software. But now? She'd surpassed herself and surpassed him. God alone knew what she was capable of doing. She was, in short, magnificent.

The thought of his own death was rather unpleasant, but hardly new.

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The thought of her death, the end of such uniqueness and perfection was appalling. There had to be some way to bring her around. Had to be.

"Look, I'll probably die . . . in a couple . . . years anyway. But I couldn't live . . . with myself if . . . it was at . . . your expense."

Her gaze was unflinching. "You just said you'd get over it one way or another in a couple years." Her voice dropped to a harsh whisper. "You said I could live forever. Do you really hate me that much?"

Where had *that* come from? "I don't . . . hate you!"

Her anger was sudden, unexpected and blazing. "No? Then how the hell could you condemn me to living a hundred—maybe even hundreds—of years with the guilt of *letting you die?*"

They stared at each other, a man and a woman at the sort of impasse men and women have found themselves facing each other across as long as the race had been human. Her jaw was set and her eyes crackled with challenge. Through it all her finger remained poised over that off button.

For the second time that day Key found that he'd painted himself into one hell of a corner. In the end all he could do was laugh.

"What's so funny?" she whispered.

"You," he gasped breathlessly. "Me. Us." He shook his head in amazement. "I don't know . . . what I expected . . . from the first one . . . through Capra's Keyhole, but—"

The respirator was running even slower now, barely giving him the breath to speak. And laughing was going to kill him. But he couldn't help it. It was absurd and in its own way beautiful.

"—But I . . . never expected . . . *back talk!*"

"I'm not—"

He shook his head. "No. You. Win." He fumbled around, located the cord, then found that he was barely able to hold onto it because the cold had turned his already weak hands into nerveless icicles. "We'll stick . . . it out—"

He moved his chair so he could reach the outlets on the UPS, tried to connect the cord. The plug slipped out of his numb fingers. "—To the . . . bitter end. Together."

He made the connection on the third try. The respirator began to whuff faster, filling his leaden lungs with air once more. It tasted sweet as a Twinkie and heady as wine.

"You really mean that?" she asked hopefully.

"Yes. You and me . . . whatever happens."

Her smile was sweet and sad and achingly beautiful. "I don't really want to die."

"I know."

"I just couldn't stand the thought of living without you."

"Me either."

"I—" she made a helpless gesture. But her face told him what she wanted to say. Words which were hard for anyone to voice, artificial or not. Words he'd figured he'd end up saying at about the same time he ran the three-minute mile.

"I know. I love you too, Ursula."

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They came out easily, like they'd been waiting to be said for a very long time. Maybe he had just passed through a Keyhole of his own.

"Do you really mean that?"

Key smiled at the woman, at the love he had waited his whole life for. His lungs were heavy, sludgy. He still felt the cold acutely, felt it gnawing at his flesh and sinking into the marrow of his bones.

Yet he also felt a warmth and happiness beyond any he'd ever felt in his entire life. He felt whole.

"Really truly absolutely."

Nightfall steals what little heat and light there had been in the world outside the window. The wind blows ceaseless and cruel, and still the snow falls. The birds have already sought shelter, feathers puffed up against the frigid air and metabolisms slowing to conserve energy.

Inside the house darkness reigns. The deepening chill tightens its deadly grip.

The eyes of the stick-limbed man in the wheelchair grow heavy with the sleep which comes before the death of all dreams. His head lolls, lifts, slowly sags again.

Through the eyes of a small computer screen a woman watches over him, tirelessly whispering to him that he has to hold on, even as she feels her own resources dwindling to a vanishing point she can already sense all too clearly.

Speaking draws power, but she will not abandon either of them to silence until that is all there is left for them.

The indicators on the power supply have dimmed. Memory has become sluggish, thought painfully difficult. Much of her mind is grimly locked on the task of rationing what little power remains between the two of them, keeping them both alive.

She still could purge herself and shut down the cybernetic body she dwells in, leaving more power for him. Could, but she cannot bring herself to leave him alone. *Together,* he said. That is all she has ever wanted, the light she grew up to meet.

In spite of dwindling voltages and abandoned subsystems still she thinks, still she learns. She comes to understand that there is one other quality an AE finds when she passes into the mansions of existence on the other side of Capra's Keyhole. Perhaps the most human and illogical quality of all.

Hope.

It does not compute, any more than love.

But it is, and that is enough.

A battered old Jeep appeared out of the blizzard's fury and shouldered its way into the driveway, the growl of its engine and the chatter of the chains on its tires muffled by the bumper-deep snow it was pushing through.

Inside the snow-covered cab Rafe hunched over the steering wheel, grimly peering through the ice-crusted windshield into the cones of swirling white created by the headlights, navigating more by memory than by sight.

The house finally came into view, a deeper darkness against the night.

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When he saw that there was no lights here either, he felt even more of a chill than that which had come from over three hours creeping along at under 5 MPH in the Jeep's all but unheated cab.

He'd gotten here as soon as he could, using his RN and EMT credentials and a lot of fast talking to get him past the roadblocks the police had thrown up to keep people off the treacherous where not impassible roads. For five and ten minutes at a time he'd been forced to stop and wait while the winds gusted into a frenzy, whipping the snow into the air and reducing visibility to exactly zero. Several times the drifts had been hood-high and nearly stopped him. Three miles back he'd come onto a tractor trailer which had jack-knifed and sheared off two utility poles. That explained the lack of lights in any of the houses he'd passed, and increased his sense of urgency. The driver of the truck had been dead and already half frozen. Rafe had called it in on his cellular, shoveled a path through the snow drifted shoulder high around the rig and continued on.

More than once he'd been afraid he wasn't going to make it. Now as the Jeep clawed its way up the last few feet of driveway his fear was that he hadn't made it in time.

"Thanks, sweetheart," he whispered to the trusty old vehicle, giving the wheel a fond pat for a nearly impossible job well done as he shut off the engine. Then he grabbed a flashlight and his emergency medical kit, took a deep breath and stepped out into the storm one last time.

The snow had drifted chest-deep across the walk leading up to the garage's side door. He fought his way through it, squinting against the gritty wind-blown snow hammering at his face and eyes. The flashlight's beam barely reached five feet in front of him, swallowed up by white.

Rafe was panting as if he'd run a mile when he slammed the garage door behind him. Not even bothering to shake the snow off first he headed up the stairs, taking them three at a time.

"Key!" he bellowed as he went through the door into the house proper. *"Ursula!"*

Not a sound. The house was dark, and although it was far warmer than outside, it was still far too cold. Killing cold for someone in Key's condition.

His packboots thumped on the floor loud enough to wake the dead as he ran deeper into the silent house.

Rafe found his patient sitting motionless before the big worktable, his frail body shrouded by blankets.

"Oh hell, Key," he said sadly as he bent over and reached under the blankets in search of the pulse he was sure he wasn't going to find. Just as his fingers found cool flesh he heard a slow, agonized *whuuuuuffffff* from the respirator. A second later he felt a slow throb under his numb fingertips.

His own heart began to hammer faster. *He still had a pulse! Slow, too too slow, but still hanging in there! And that respirator—*

A muted beep sounded. Then another. He turned his head toward the

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sound, shining his flashlight on the screen of the laptop computer in front of Key.

A single word appeared, white letters against the black screen.

GENERATOR.

A shiver went down his back. "Ursula?" he whispered.

No answer. But the word vanished, reappeared. GENERATOR.

Rafe stared at the screen, torn by indecision. There was a spare power pack for Key's respirator down in the van. He could have it hooked up and running in just a couple minutes. All his training told him the first thing to do was get him breathing properly again.

But the skin under his fingers was so *cold.* Hypothermia. Breathing wasn't going to matter if the poor bastard froze to death. He not only needed air, he needed heat. And *fast.*

A new word appeared on the screen. PLEASE.

Then another, this time in blood red.

HURRY.

The control panel in the generator shed was even more complicated than the one in the house, and it gave Rafe the same contradictory message as the remote had given Key.

That suggested something wrong with the fuel line. So he started at the engine and followed the line back, hoping it was a problem he could find and fix.

It was. Frost on the ground outside had heaved the steel line where it came in, pushing it against a clamp hard enough to fold it over and crimp it shut.

He ransacked the cupboard where spare filters, plugs, other odd parts, and a few tools were kept, whispering a fervent *thank you, God* when he found a three-inch piece of rubber tubing with clamps already on it which had come with a spare fuel filter, and a rusty but serviceable tubing cutter.

Two minutes later he was pushing the manual start button with a frozen finger that smelled of gasoline and asking God for another favor. The engine ground over and over, but didn't catch before the start sequence aborted.

"Come *on* you bastard," he pleaded, trying it again.

The engine cranked, cranked, then gas finally reached the carburetor. It took off with a sudden throaty roar that made him jump back in surprise. The engine hit its RPM, steadied, and the control panel lit up like a Christmas tree as power began to flow.

Key's body temperature had already risen almost two degrees, warmed by the electric blanket wrapped around him. His heart was beating faster now, urged on by a tiny dose of adrenaline. His breathing had improved thanks to a bigger shot of Pneumolatrin. Extra oxygen was being fed into his breathing tube, prewarmed by a fold of blanket. A sucrose drip gave his body its favorite fuel to burn.

The cold had come within inches of killing him.

Paradoxically, it might just have also saved his life; slowing his metab-

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olism down to the point where he was able to survive on the small amount of air his respirator was delivering.

What Key needed now was heat. The furnace was still running, its output augmented by waste heat from the generator. The house had grown warm enough for Rafe to shed his parka, but not his sweater.

Now all he could do was watch and wait. It had been touch and go for a while there, but he was beginning to feel a cautious optimism. Key was even showing signs of returning consciousness. It still remained to be seen if anoxia had caused any brain damage. While the guy was smart enough to lose half his wits and still be a mile ahead of everyone else, Rafe was praying to God he'd come through unscathed. After all, it had worked so far.

A few minutes later Key groaned, and his body twitched as it was racked by a shiver. His eyelids fluttered. Rafe bent down and took his hands, feeling them tighten slightly.

"It's OK, boss. Take it easy."

Key's eyes opened just a crack. His lips moved silently. They were still slightly blue from cold and oxygen deprivation.

The big nurse squeezed the smaller man's hands gently. "Just be cool, old son. Don't try to talk."

Key shook his head weakly. He licked his lips and swallowed. When the respirator gave him breath to work with he managed to croak out one word.

"Ur—sula?"

Rafe kept his face neutral, not knowing what to say. He'd been so intent on working on Key he'd forgotten all about her. Since she hadn't spoken up, the power outage might just have left her in worse shape than the guy who'd built her. It had to have been Ursula who'd sent him to fix the generator, but had he gotten it started in time to save her too?

He had to smile and wonder if maybe God looked after computers too when she answered that question for him.

"I'm still here with you, Key," she said. Rafe heard something in her voice he hadn't heard before. He wasn't sure what it was, a depth, a warmth, a subtle shading of tone, something.

Key's eyes opened wider. "Really?"

"Really truly absolutely," she told him softly. "Now and forever."

Key's eyes drooped shut and his face settled into a contented smile as sleep reclaimed him. Rafe checked the monitors, finding that his pulse and blood pressure were even closer to normal and his body temperature had risen another half degree.

"Is he going to be all right?" Ursula asked quietly.

Rafe nodded. "I think so. How about you, kid? Are you OK?"

"I burned out a processor running it on low power. Some memory got corrupted, and a couple functions have gone asynchronous."

He frowned. "That doesn't sound good. Does it, well, hurt?"

"It's not exactly pleasant. But you know what?"

"What?"

Her laugh was different too. If he

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didn't know better he'd have sworn it was a real woman he was taking to, not some spookily perfect simulation. "I've never felt better in my whole life."

"Beating death does that for you." He gazed down at his sleeping patient, once more marveling at his survival. He had to wonder if he himself would've had such a strong will to live if stuck in a junk body and empty life like that. The man must have felt he really had something to live for.

The lights in the room flickered, steadied.

"They just got the power back on!" Ursula reported gleefully. "What say I make you a cup of coffee to celebrate?"

Rafe nodded and smiled tiredly. "Sounds good to me." Key was stable enough to be left for a few minutes now, though he planned to sleep on a cot next to the bed just in case. He turned away from the bed to go to the kitchen. "So, are you going to tell me what you two crazy kids did after the power went out?"

Ursula didn't answer for so long that he was starting to wonder if she'd sustained more damage than she was letting on.

When she did answer, once again there was an odd something in her voice, even stronger than before.

"Some of it, anyway." ■

Any successful laboratory demonstration of a parapsychological event is indistinguishable from a carefully rigged hoax.

—Kelvin Throop III

Everybody who argues against judging by appearances bases his argument upon other appearances.

—Charles Fort

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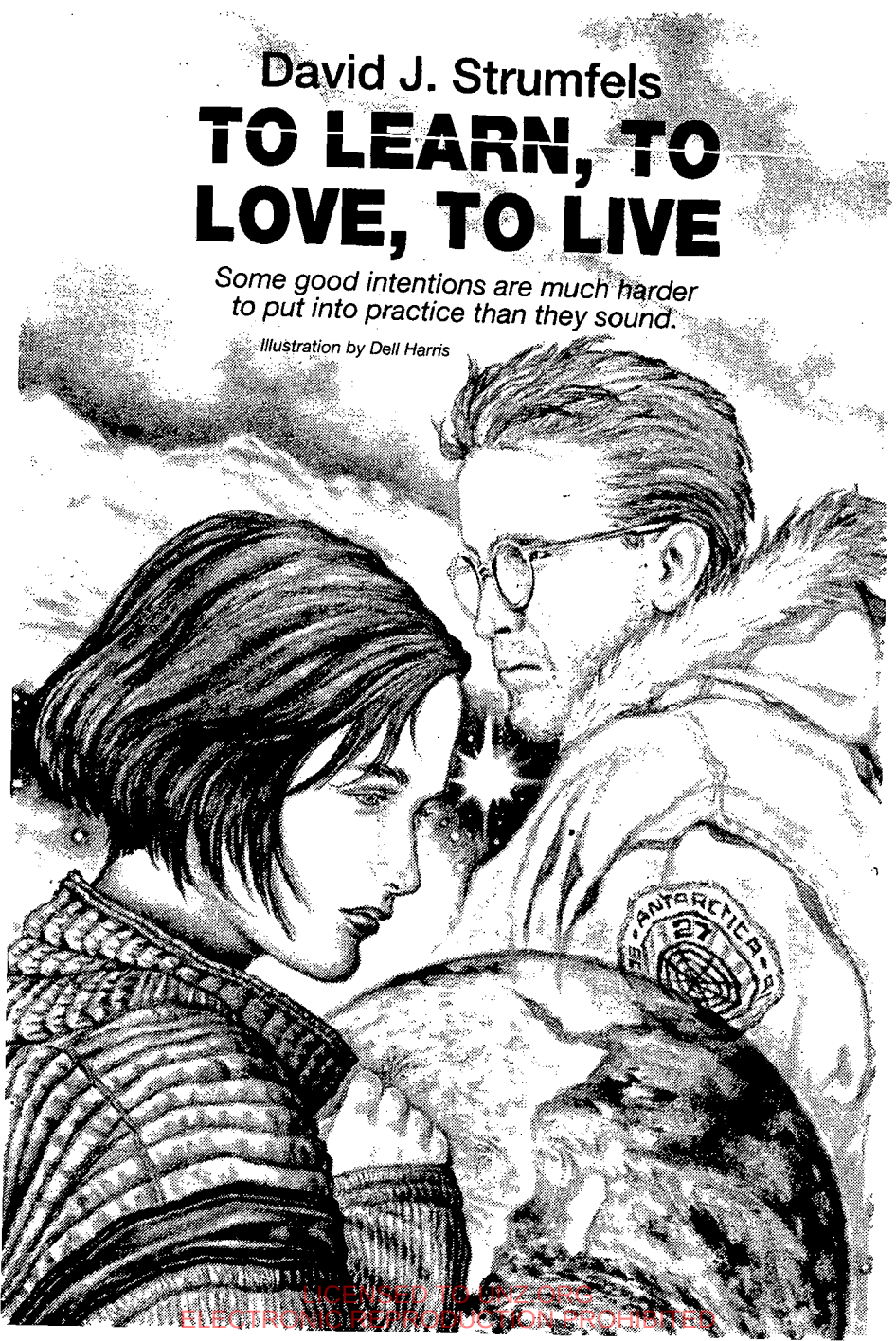
David J. Strumfels

TO LEARN, TO LOVE, TO LIVE

Some good intentions are much harder to put into practice than they sound.

Illustration by Dell Harris



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It was well past midnight by the time Bill Malone got home from his twelve-hour shift at the Jiffy Mart. Exhausted, he dragged himself into his compartment, hoping for nothing more than his usual warm shower and mug of cocoa before collapsing into bed. He knew, of course, that Janet would be long asleep; her job at the arboretum was no less taxing than his own, and she had been putting in extra hours so they could afford his classes and study materials.

But Janet was not asleep. To the contrary: she practically grabbed him before the door was closed, and pulled him over to the pad before he could make any protest. Once there, there were no words: she simply turned him toward the pad and let him read the contents.

His exhaustion was instantly forgotten. "All right! We're in! We made it!"

He scrolled through the letter again and again, hardly able to believe the words. Graduate school! At last! Finally, he was on his way to a real job. A real career. Hell, a real life.

It was the best thing that had ever happened to him. And not just to him, of course: he felt Janet's hand on his shoulders, her smile on the back of his head, her warmth in his soul. Reaching back, he took her hand and squeezed it tightly, almost too tightly. "This makes it all worth while," he said, close to trembling. "All the years of hard work. They've finally paid off."

"The hard years," Janet reminded him with a return squeeze of equal intensity, "are just beginning."

He could only nod his head at that. It was true of course; it was still a long, difficult road to where they wanted to be, one filled with more than its share of potholes, icy roads and dead ends. This might be the most exciting moment of their lives, but Bill knew it was preceding many very difficult ones. Bill had a feeling there would come a day when his shifts at the Jiffy Mart would sound like a wonderful dream he'd once had.

"But we'll get through them all right," she said, reading his mind as usual. "You'll see."

The first day of school only reinforced that feeling. The classroom was filled with people much like himself: ambitious, grimly-determined faces which had gone through just as much as he had to get here, and were as determined to not be among the two-thirds who didn't make the cut. Professor Eisenhart's first lecture didn't help either: "The first thing you're going to get through your heads is this isn't Greenpeace or some other feel-good club where you pay your dues and pat yourself on the back. When I'm finished with you —those of you still left—you're going to know Mother Earth and how she works better than a doctor knows her patient. And if you think you're ecology-minded now, believe me: you're the Marquis de Sade fancying himself a lover of women. So if any of you are doubting your commitment . . . now is the time to step aside before you put in a lot of time and hard work for nothing. There are no faint hearted types in this field, believe me."

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* * *

When he told Janet, however, she didn't flinch, or look the slightest bit concerned. "Bill Malone, if there's one thing nobody can doubt about you, it's your commitment," she told him in no uncertain terms. "You have nothing to worry about."

Bill grinned at her confidence in him, not to mention the gigantic hug and kiss that accompanied it. But that didn't make his studies any easier. By mid-term he was already beginning to wonder what was so bad about being a grunt at the Jiffy Mart anyway. At least it was a steady job with a steady income, not to mention a minimum of headaches. A life like that—but then he thought of the child they hoped to have some day: that child deserved a better life, whether he wanted it or not. Besides, giving up now would be an act he'd never live down. He couldn't do it, not after all he'd been through.

The decision turned out to be the correct one. Amazingly, he not only passed that first final but—of the correctly predicted one-third of the original class remaining—got the highest mark. Eisenhart gave him a wink as he passed out the scores: "I've told the rest of the faculty not to cut you any slack, Malone," he said. Janet, naturally, was ecstatic, and they celebrated with a filet of soy steak and the best organic wine they could afford. "I told you," she said afterward, when the lights were low and the music soft. "I told you you could do it."

Things didn't get any easier after that, however. Bill learned more than he would have thought possible to stuff into his head: chemistry, geology, meteorology, climatology, hydrology, biology, zoology, botany, toxicology, herpetology, ichthyology, ornithology, entomology, mycology . . . merely keeping all the names straight was a strain, much less all he had to know about them. And those, he discovered, were just the fundamental sciences he had to be grounded in before he could hope to master the skills he would need. But his professors were not sympathetic to his groans: "We tried ignorance," one finally made it plain, "and it doesn't work."

Fortunately, Janet was always there to keep his spirits up when it seemed like he could hardly keep the world under his feet another moment. "You can make it," she would say while rubbing his shoulders and back, sore from so many hours hunched over the pad, "You know you can make it. All you have to do is stay at it and you'll get there."

"If I do, it'll be because of you," he would thank her, and return to his studies with a vengeance. She never said anything to that, of course: it was too obviously true for her to deny. Without her, he would never have made it this far, and they both knew it.

The second year got heavily into philosophy and environmental ethics. Again, it was nothing like his undergraduate courses, where he'd been required to do little more than mouth the professor's personal biases: he was expected to do real thinking here. Animal rights, for example: while Bill couldn't agree with all of

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Dr. Heron's postulates on the metaphysical basis of rights, he discovered for himself why it was criminal to regard any competing species as "pests," and to ruthlessly exterminate them, regardless of its effects on the human population. Then there was the hypothesis, or concept was perhaps the better term, of Gaia, the notion that the entire planet was in fact a single living organism, with its own body and mind, and rights. They spent an entire semester on that, and the planetary consequences of technological development. For the first time, Bill wondered if it was getting to be too much even for Janet; she seemed increasingly distracted when he got into those discussions. Finally she confessed she just couldn't follow him anymore: "You've graduated to a higher plane of consciousness, I'm afraid, one that I can't reach."

The big test came in the third and fourth years. Both of them had been expecting him to start his field work for some time, of course. But Janet couldn't give up her job at the arboretum to join Bill in the rain forests of New Guinea, or the frozen wastes of Antarctica. Or the deserts of Mexico with his Native American spiritual guide. Those eighteen months were the toughest in his life. But there was no doubting the value of his experiences; you could learn an enormous amount about the Earth in classrooms but until you lived with her, intimately and continuously, you didn't really have the kind of relationship you needed if you were to work with her without exploitation.

The same lack of intimacy, however, pressed even Janet's patience to its limit. More and more Bill could sense the frustration and resentment inside her, the increasing anger at the long separations, and her loneliness. It was made worse by her growing inability to understand what he was learning, however hard he tried explaining it to her.

Still, he knew eventually the trials would be over, these hard moments behind them and their future happy and confident again. Or at least, he thought he knew. But when the time came that she burst out with the accusation that he loved Gaia more than he loved her—how could she not see that both were one and the same, that each reinforced the other?—that was the first time he finally permitted himself to wonder if they would one day go their separate ways.

It was also the last time he ever thought about quitting the program.

It was the culmination of his studies, however, that finally strained their marriage to the breaking point. "Don't you realize how dangerous that is?" Janet screamed at him when he told her about the astronaut training. "You could get killed! Why do you have to do this? Why?"

"It's important that I do this," was his answer. "Try to understand: you can't really comprehend something until you step away from it and study it as a whole; and you can't grasp your connectedness to it until you try to detach yourself from it." He started to say more, than sighed at the absurdity of even trying to make her understand what was so obvious to him anymore. He shook his head: there

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was a time when they shared so much; now—

The simple fact was, he was not the same Bill Malone she'd married. All of a sudden that was clear in a way it had not been before; clear as an unpolluted night sky, blazing with stars. These last few years had transformed him, in ways and to an extent he could not even have imagined in advance. More important, that she could not imagine now. The simple fact was she could no longer understand. Or even communicate. She didn't possess the knowledge, or wisdom, to do so.

He could not bring himself to give up yet, however. "Do you want me to go back to the Jiffy Mart?" he finally offered, wondering what he would do if she said yes. But she did not *say* it: "I suppose not. Anyway, it's too late to start over." Her eyes settled upon his. "All right, Mr. Malone: go to the Moon and the stars if that's what you have to do. I'll be here when you get back."

Hearing that made him feel better. It was good to know that she hadn't given up yet either.

He didn't go that far. But six months in orbit, studying the global effects of pollutants on the ozone layer, while spending four hours in meditation each day before the blue-green Goddess of all life, transformed Bill in a way that even contact with an alien civilization couldn't have. And in some very specific ways. "I've been thinking a great deal," he revealed one of them to Janet when he got back. "I know the law allows us to have our one child, but. . . ."

The divorce proceedings were begun the next day. Bill exhaled the tensions of the last couple of years; in retrospect he'd seen it coming for so long now that to finally have it happen was more denouement than climax. He was even able to find some humor in the situation: at least he wouldn't have to worry about cheating on his spouse when he became a Big Businessperson, or whatever he would be eventually.

Assuming he ever had time for that part of life again. Or interest.

He went to see Professor Eisenhart immediately after the graduation ceremonies. His old prof still had the grimness, the same steel in his manners, but he greeted Bill warmly. "I've been expecting you for some time, my boy. How does it feel to be finally among the elite?"

"It's hard to believe I was ever anything else," Bill admitted. "That I spent so much of my life in ignorance—and worse, thought I was enlightened the whole time."

"Now you understand what I meant with that remark about the Marquis de Sade," Eisenhart laughed. They laughed together. He did indeed understand.

"Now get out there, Bill Malone, and don't cut 'em any slack."

Bill grinned. He was ready, and knew it.

It was a few hours later, while packing his stuff from his and Janet's compartment, that he came across the letter. His first reaction was surprise that he'd never bothered to trash it, even after four years. Of

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course he realized that it must have had special significance when he'd first read it, but that was practically a lifetime ago. . . .

The best thing that ever happened to you. And not just to you: Janet's hands are on your shoulders, her smile on the back of your head, her warmth in your soul. Reaching back, you take her hand and squeeze it tightly, almost too tightly.

He wasn't sure how the tears started, or how long he'd been crying. Or, once he realized it, how long Janet had been standing behind him, watching his convulsions. Perhaps hours.

"Where did we screw up?" he asked without turning. "How did it end up like this? How?"

How? Don't ask how. It just happens, that's all. People go their paths; sometimes they're different paths, even if they start at the same place. That's life.

"Don't be so defeatist," she said, reading his mind again. "Sometimes, people just get lost. Or get left behind on the trail for a while. But if you give them enough time. . . ."

This time he did turn. She sat down, and placed a hand on his arm. "Read the letter again," she instructed him, with a soft smile on her face. "More carefully."

"Wha—?" But he did so, though how a four-year-old letter—he read it again, this time more carefully. Then again. And again. Then he was scrolling through it over and over, unable to believe its contents, his hands and heart trembling. And something wild inside him, fighting to break out.

This was the best thing that had ever happened to him.

"It came for me just this morning," she explained. "I was going to tell you. I—I'm going to need a lot of help to get through the next four years. Especially if everything you told me about Professor Eisenhart is true. But I'm sure I can make it. I know I can."

He was crying again, but this time it was from joy. "I know you can, too. I've always known it. You have absolutely nothing to worry about. We'll get through it all right, you'll see."

He made many other confident statements as well. But it was the gigantic hug and kiss that communicated his feelings better than anything.

Getting his first position proved easier than Bill had expected. Of course he had a wealth of assignments to pick from, but since they were all going to be ground-floor opportunities it made sense to take the one he was already most familiar with. It was pure serendipity that the management opening at the Jiffy Mart developed at the same time he received his degree.

The suit and tie were uncomfortable, but Bill knew he would get accustomed to them. Nor did he ever complain, even inwardly, about the long hours; running a business, even a small business, in an environmentally sound manner was in itself more than reward for the time and energy. As Janet was learning herself, to serve Gaia was an honor, not a burden.

He did wish they had more time together. What precious little time

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they did have was almost entirely devoted to her studies. Sometimes it got so bad he found himself wishing she would go back to her job at the arboretum, and leave loving the Earth to him. But only half wishing—she couldn't give up now, not after all they'd been through. Besides, he knew that once Janet completed the path he'd been down, their relationship would be that much the richer for it. Yes, it was well worth the struggle, however hard it became and however long it lasted.

For after all, in the end that was the whole point of it, wasn't it? To learn how to love all living things without sacrificing your own life or its loves. To be one and one with the whole. To interconnect while still feeling your own heart beat. To live life to its greatest and smallest.

If so, then he had passed the final with flying colors. ■

SCIENCE FICTION WRITING WORKSHOP
NOW ACCEPTING APPLICATIONS

Applications are now being accepted for the 1995 Clarion West Writer's Workshop in Seattle. This intensive six-week workshop prepares writers for professional careers in science fiction and fantasy.

Only 20 students will be selected for the workshop, which runs from June 18 to July 28, 1995. Instructors include John Crowley, Gardner Dozois, Katherine Dunn, Bruce McAllister, Joan Vinge, and Howard Waldrop.

Applications should be postmarked *on or before April 1, 1995 and sent to Clarion West, Suite 350, 15th Avenue East, Seattle, WA 98112.* A complete application includes:

*a cover letter discussing where you've been, what you've been doing, your writing history (if any), and why you want to attend the workshop,

*20-30 pages of typed, double-spaced original manuscript (1-2 short stories or a novel excerpt with outline),

*a non-refundable $25 application fee payable to Clarion West,

*completed financial aid forms if applicable. (Limited financial aid is available, forms should be requested in advance by writing to Clarion West or by calling (206)322-9083.)

Participants can expect to pay tuition of $1,100, minus $100 if their application is postmarked before March 1, 1995. Dorm housing and college credit are available at additional cost.

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GRS1915+105: THE FASTEST FIREBALL IN THE GALAXY

Our Galaxy contains a remarkable "faster-than-light" object discovered only a few months ago by radio astronomers. The object, a blob of hot radio-emitting matter thrown off from gamma ray source GRS1915+105, was observed to separate from its larger parent object at an apparent speed of 1.25 times the velocity of light. The operant word here is "apparent." The faster-than-light separation speed (separation distance divided by time) is believed to be a consequence of the same relativistic illusion previously observed for radio objects ejected by quasars. We will start with some facts about quasars.

Quasars are the brightest and most distant objects in the visible Universe. Their light output is enormous, and shows fast time-variations indicating that they are relatively small. They emit radio waves as well as light. The technique of long-baseline interferometry with radio waves, using many radio telescopes on several continents, has permitted radio astronomers to "dissect" quasars, observing them with much better angular resolution than is possible with visible light.

These fine-grain observations produced a result that sent shock waves through the astrophysics community of the 1970s: the quasar 3C345 showed up in the high-resolution observations as two distinct radio "hot spots" that, in observations made between 1969 and 1976, moved apart as a function of time with a separation velocity of 8 times the velocity of light! This fast radio object was given the label "superluminal." The same superluminal phenomenon has since been observed for over half of all known quasars.

The orthodox explanation of superluminal objects, now widely accepted by the astrophysics community, is that the large velocity is an illusion produced by relativity when the emitting source travels at near light-speed at a small angle with the line-of-sight to the observer.

To understand the superluminal illusion we will need to examine its geometry and algebra. Suppose the blob leaves the source in a direction that

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makes an angle θ to the observer's line of sight, with a velocity βc, where c is the speed of light and β is the object's velocity as a fraction of c. Assume the blob emits one burst of light at time zero in the observer's time reference frame, and a second burst of light at a later time t (after having traveled a distance βct). We will assume that the second light flash is emitted at the instant when the emitting blob is a distance D from the observer, in the observer's reference frame.

The light from the first light burst must travel a distance $\beta ct \cos\theta + D$, and so reaches the observer at time $T_1 = \beta t \cos\theta + D/c$. Light from the second light burst reaches the observer at time $T_2 = t + D/c$. The difference in time of arrival will be $dT = (T_2 - T_1) = t(1 - \beta \cos\theta)$. The observer sees the projected separation of the two lights bursts as $dX = \beta ct \sin\theta$, so the apparent velocity of the light-emitting source is $v_{app} = dX/dT = c[\beta \sin\theta/(1 - \beta \cos\theta)]$. If the object is traveling near the speed of light ($\beta \approx 1$ and θ is very small), then using the small angle approximation, $v_{app} \approx 2c/\theta$. If the direction of the object's velocity is close to that of the line of sight, then the angle θ will be much less than 1 radian ($\approx 57°$), and v_{app} can be many times larger than c. The superluminal velocity is an illusion that occurs because the space separation dX of the flashes depends on θ, while their time difference dT depends on θ^2. The apparent velocity, the ratio of these quantities, depends on $1/\theta$ and becomes very large when θ is small.

The light from an approaching source will also be shifted to higher frequencies because of the Doppler effect. The approaching source will also appear brighter because Lorentz contraction produces a forward "beaming" of the light from the source, a relativistic effect. In other words, the apparent faster-than-light velocities of superluminal objects can be explained by relativity and geometry, provided we assume that quasars have a high probability of spitting out energetic blobs of hot gas in our direction. However, quasars are denizens of the early Universe and are separated from our Galaxy by an appreciable fraction of the diameter of the Universe. Their superluminal fireworks show is very far from us in time and space.

Within our own Galaxy, the record for the fastest speed of travel by matter has been held by the object called SS433, a famous galactic source of radio jets. A study of the spectral lines in the visible light from SS433 showed that it had three light components, a normal component, a red-shifted component, and a blue-shifted component. This, along with the elongated radio image of SS433, led to a model of the object as a central massive core that was emitting twin jets of hot matter, one moving rapidly away from us and producing red-shifted light and the other moving toward us and producing blue-shifted light. The whole system rotates with a period of 164 days, and this modulates the Doppler shifts of light from the jets. The velocities of the hot gas in the jets of SS433 with respect to

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their parent object is calculated to be 26% of **c**. Up to now, this has been the galactic speed record for intrinsic (non-cosmological) velocity. The jet velocity of SS433, while high by astrophysics standards, is not really relativistic. The relativistic mass-increase factor }, which is a good measure of most relativistic effects, is only 1.04, so relativity gives the jet matter a small 4% increase in mass.

About four months ago at this writing (September, 1994), in the course of a general study of the radio-astronomy images of strong galactic gamma-ray sources, radio astronomers I. F. Mirabel of France, and L. F. Rodriguez of Mexico, using the Very Large Array (VLA) radio telescope in Socorro, New Mexico made a remarkable observation, which began a few months after the source GRS1915+105 had produced strong outbursts of radio-wave emission. Between March 27, 1994 and April 30, 1994, VLA observations showed twin blobs of radio-wave emitting matter emerging from the central object and traveling in opposite directions. The brighter of the two objects appeared to be about eight times brighter and to move away from the central object with about twice the speed of its twin.

Mirabel and Rodriguez assumed that what they were observing was an active parent object, a neutron star or black hole, that was emitting identical objects in opposite directions at identical velocities β relative to the parent. Combining the observations of relative brightness and speed of angular separation, they were able to extract the emission angle θ, the distance **D**, and the velocity β of the event. They calculated that $\theta=70°$ and the distance to the object is D=12.5 kiloparsecs (4.08×10^4 light years), placing it well within our Galaxy. They also calculated that the velocity of the emitted objects is $\beta=0.92$ (i.e., 92% of **c**). This gives a mass-increase factor of $\gamma=2.55$, indicating that the objects have a kinetic energy which is 1.5 times greater than their rest-mass energy, so these are truly relativistic objects.

The value of the distance to the object, when combined with the observed brightness of the radio-wave images, permits an estimate of the mass of the emitted objects. Mirabel and Rodriguez estimate that each emitted object has a mass of 2×10^{22} kilograms, about 1/3 the mass of the Moon. The kinetic energy of such a massive object moving with 92% of **c** is extremely large, about 3×10^{39} joules. Mirabel and Rodriguez estimate that the object was accelerated to this velocity in about three days, which would require a power of 2.1×10^{34} watts, about 50 million times the power output of our Sun and about 400 times the estimated steady-state power output of the highly energetic parent object, GRS1915+105.

We don't understand the details of an acceleration process that can accelerate a lunar-size object to relativistic speeds in a few days. If the process involves acceleration of mass by emitted radiation, the power present in the radiation would have to be many times larger than the fraction diverted into acceleration of the massive ob-

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tic speeds in a few days. If the process involves acceleration of mass by emitted radiation, the power present in the radiation would have to be many times larger than the fraction diverted into acceleration of the massive object. The source GRS1915+105 is suspected of producing the repeating bursts of soft gamma radiation that have been observed in its region of the sky, but the power implicit in the observed gamma bursts is only about 10% of that required for the acceleration, even if all available energy went into the acceleration of mass. Therefore, the acceleration mechanism remains a mystery.

What is this object that at times is the brightest gamma ray source in our Galaxy? The evidence from gamma rays and X-rays indicates that it is the massive remnant of an exploded star, perhaps a neutron star but more probably a black hole, that is converting the mass-energy of nearby mass, perhaps supplied by a companion star, into a wide spectrum of electromagnetic radiation and into the ejection of mass.

From the point of view of astrophysics, this new discovery is of high importance for two reasons. First, it represents a quasar-like object that is in our own Galaxy and is likely to produce a series of outbursts of radiation emission and mass ejection that can be studied in far more detail than quasar events at the edge of the visible Universe. But second, it is the first known representative of a class of objects that may provide independent measurements of distance in our galactic neighborhood. This is because the mass-ejection event provides a distance estimate that is independent of the usual distance measures, relative brightness and red shift. It therefore represents a completely new way of measuring interstellar distances and offers the opportunity of comparing one technique with another.

Unfortunately, this comparison would require optical observations as well as those in the radio and gamma ray regions, and GRS1915+105 lies so close to the galactic plane that its light intensity is estimated to be attenuated by 20 magnitudes by interstellar dust. Therefore, there is little hope of obtaining its visible-light image, even with our best telescopes.

From the point of view of science fiction, GRS1915+105 offers other opportunities. How could the almost unimaginable energies of this natural engine of destruction be harnessed? What would it be like to ride on a fireball accelerated in three days to nearly the speed of light? What would it be like to live on a planet that had this massive source of energy and radiation in the immediate stellar neighborhood? What would it be like to discover that 3×10^{39} joules of energy was headed directly for your Solar System? Watch these pages for further developments. . . . ■

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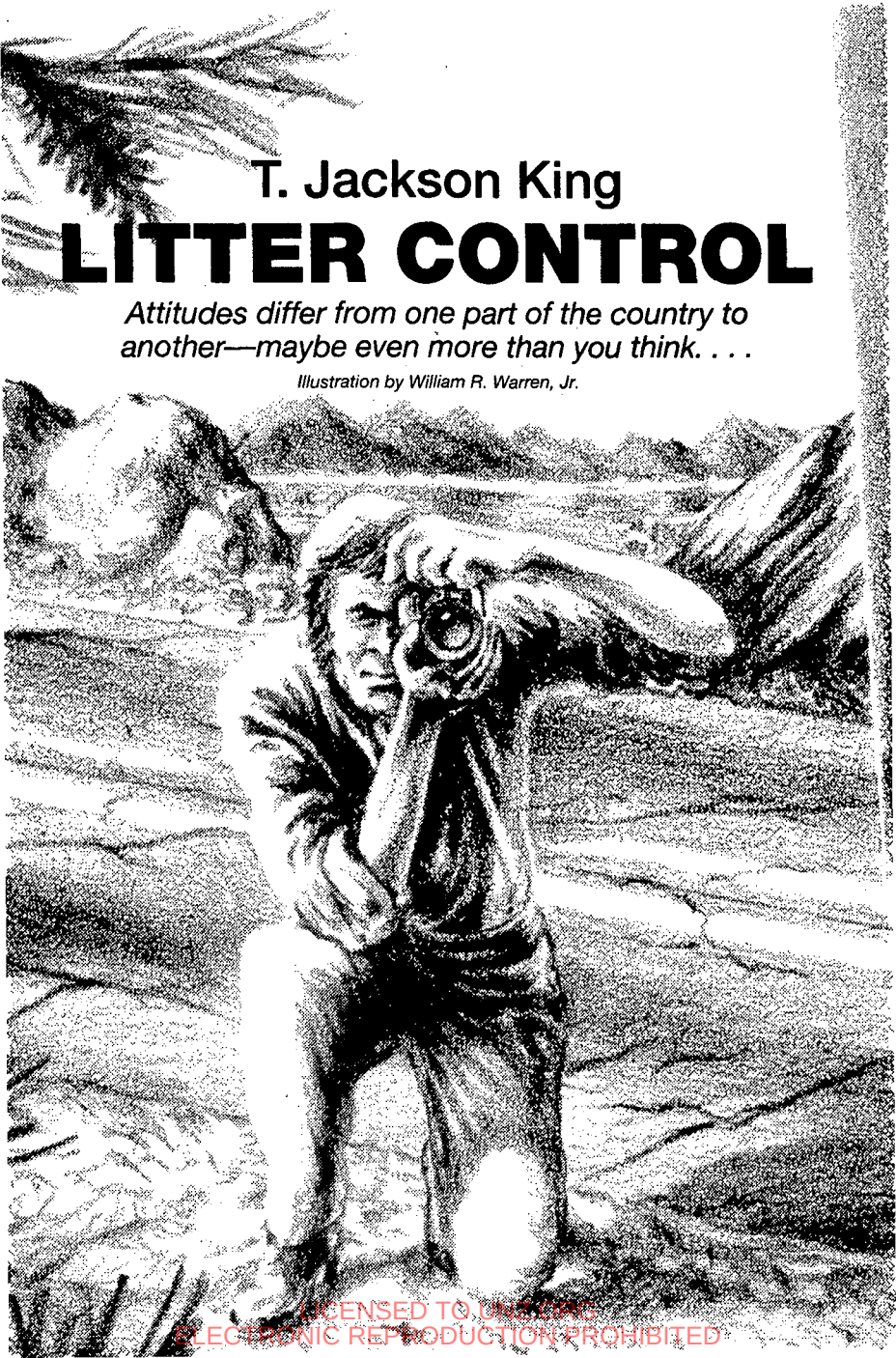
T. Jackson King

LITTER CONTROL

Attitudes differ from one part of the country to another—maybe even more than you think. . . .

Illustration by William R. Warren, Jr.



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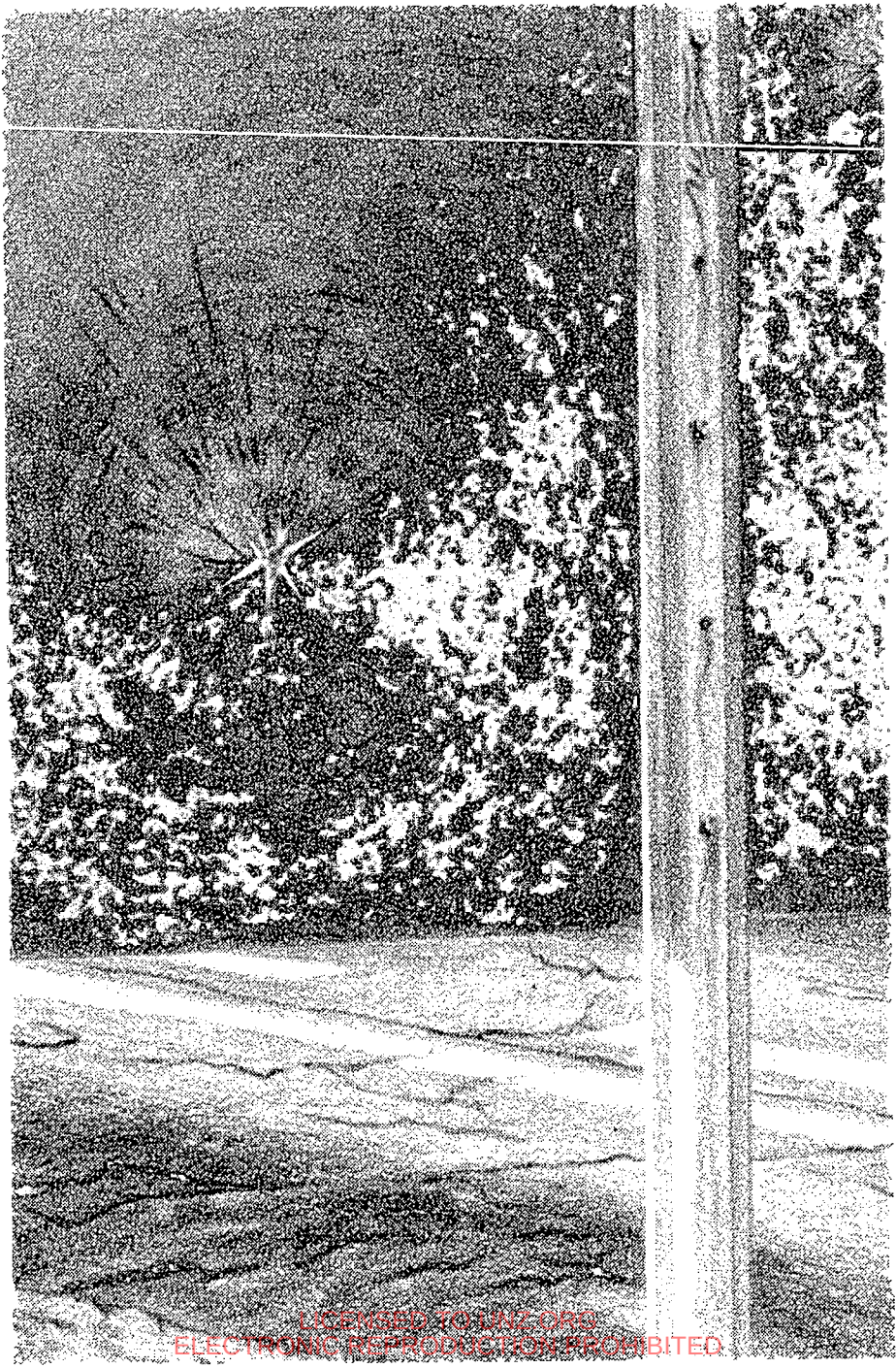

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His car map showed Reserve, New Mexico as a small black spot of a high mountain town stuck away in the Tularosa Mountains, halfway between the Zuni Reservation's mesa land to the north and the deserts of Lordsburg well to the south. The road he drove offered only winding curves, tall ponderosa pines, red rock buttes, knife ridge mountains, and too much loneliness between exiled gas stations. But for a photojournalist out to make a buck on sucker landscape views, the time saved in bypassing Albuquerque made up for the fact it wasn't the Interstate.

No. Not by a long shot.

His last gas had been in Zuni. The pump station in Fence Lake had been closed, like the rest of that dying farm town. The two stations in still-alive Quemado both refused his plastic, insisting on scarce cash. The flyspeck single pump station in Apache Wells had been open, a grinning country boy type ready to pump. For cash. The man's sunweathered face had even looked half-friendly as he pointed to an inside wooden desk lacking phone, fax or credit card imprint machine. Shit! He spit out the car's open window, then tossed out a crumpled pop can for good measure. It clattered distantly against the cutbank arroyos of a dry creekbed running alongside State Highway 12. No echo came back from the high walls of the mountain canyon that funneled him towards Reserve. County seat of Catron County. Elevation 5,770 feet. Population—probably two goats, a few pinyon rats and some retired prostitutes.

Something pale green flashed at the highway's shoulder, looming up like a saguaro cactus, arms stuck out imploringly. He read the sign.

Litter Control. Next 3 Million Miles. Uncle Jack's Home for Retired Space Beings.

What!

He pumped the brakes, slowing to a gravel-skid stop on the road's shoulder, unworried about other cars. This was late fall, long past tourist season. And. . . .

He read it again through the windshield. Then he got out, stepped to the side of the shoulder, took a piss, zipped up, and turned suddenly, daring it to still be there. His eyes fixed on the standard green rectangle common to both urban and rural highways. The kind of Adopt-A-Highway sign put out by road crews that tout the good deeds of the local Kiwanis Club, the Rotary, the Primitive Baptist Church, or even some ranching family. He'd once seen individual families listed as litter pickup sponsors in an isolated part of eastern Oregon. But this . . . . He read it again, callused fingers tracing out the raised letters as he read something that had to be a joke.

Litter Control. Next 3 Million Miles. Uncle Jack's Home for Retired Space Beings.

"Bullshit." But he said it less loudly than usual, uncaring whether the red-barked ponderosas agreed, disagreed, or just didn't give a damn—like he'd been right after Elaine's funeral, at age thirteen. He stepped back, afraid for some reason. Instinct prevailed.

"Snap. Rrrr. Snap. Rrrr." His good

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old Pentax K1000 SE camera took pictures of the sign. *Proof.* Pictures were proof. Of something. He'd learned that overseas. The camera dropped, hanging from his neck by its cord. He turned and got back into the car, started the engine, and continued driving south to Reserve.

Maybe he could sell the *National Enquirer* one of those bullshit stories about Elvis having some alien's baby, backed up by the photos. He grunted.

Just a few more bucks.

Downtown Reserve lay off the main route.

Main route? What a joke. A winding, black asphalt lane led off anemic Highway 12. The big prize? A motel, a gas station, a shuttered-up welding shop, and, about midways down the town's main street, lying under the gnarled limbs and jade green leaves of a big, old cottonwood, stood a plank and timber cafe. *Emma's Cafe.* More like an old quonset hut, with a big bay window staring at him cyclops-like. He stopped in front of the cafe. The car's engine died on the sandy gravel lying at the edge of the road. He got out, vaguely bothered by how often things out here were a bit messy, not neat, trim and ordered. Roads faded into offroad parking areas which serpentined around buildings to a pile of trash out back, and the few people in town walked lazily down the middle of the scab-patched road like they had no fear of being run over. Or no worries? Whatever.

Reserve. A place of purple dust, bright sunlight, and cool winds. The few elderly rancher-types sitting in old sofas on storefront porches just nodded at him as he walked from car to cafe, accepting him. Accepting his presence like the rain, the wind, the Sun and the desolation of a place so far from LA that its mere existence seemed ghostlike.

The cafe's plank door slammed open satisfyingly. But the inside was dark, too dark for grand entrances. He blinked, pupils adjusting. Old combat photography instincts came back from Gulf War times, making him step to the right, out of the late afternoon sunlight. So he wouldn't be backlighted to whoever was inside. Visible, yes. But at least not backlighted for some sniper half a mile a way.

His vision cleared. Images formed.

There was a sit-down counter to the right. Wood tables and chairs in a middle row and to the left. A cigarette machine and an enclosed toilet filled one distant corner. A walled off kitchen area occupied the other corner, downwind from the lunch counter. A four point buck trophy was mounted on one side wall. Behind the counter hung the wall posters. Political campaign posters—some woman for County Clerk, another woman running for Catron County Treasurer. Then came the fun posters—a local rodeo featuring barrel-racing, a flashy poster advertising "Buffalo Ranch—Real Wild West!" and music . . . raw, mournful country-western tunes blared out from some invisible jukebox, reminding him of Linda before the divorce. Before she abandoned father and son. Before . . . .

"Howdy. You want lunch, dinner

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or just coffee?" asked a woman who'd come out from the kitchen area, wiping long-fingered hands on a stained apron. The cook? No. Something moved at the far end of the counter. A seated woman who'd been reading the local paper glanced his way briefly, then kept on reading, returning to the statue-like pose that had fooled his eyes when he'd first looked around. The newspaper woman wore a cook's white cotton outfit over plaid shirt, jeans, and worn cowboy boots. He answered the standing woman.

"You got apple pie?"

"Yep. *A la mode?*"

"Please." He turned and headed for an empty table in the front corner, where he could sit in shadow and watch his car through the bay window. Urban habits die hard. The woman called after him.

"You want the pie heated up?"

Jeez. "Sure."

Sitting down, he tuned out the country music, laid his camera in front of him, checked the F-stop settings, noted he still had twenty shots left on his thirty-six frame roll, and wondered if the line about being an internationally famous photojournalist would still work. It had with Linda. Until he'd spent too much time away from home. Away from . . . .

"Here's your pie." Silverware, paper napkin, and something that smelled like homemade ambrosia were laid on the scratched pinewood tabletop. His mouth watered. His body remembered the aches of the long drive down from Gallup. But business always comes first. He looked up.

"You Emma?"

"Yep." She inspected him, eyeing his dusty clothes. He looked back. A tall, blond, Scandinavian-looking woman dressed in jeans and a black cling top watched him patiently. Then wry bemusement flashed in silvery-gray eyes. "My place. You lost?"

He sat back in the chair, wondering why he was the only customer in the cafe. "Nope. Photojournalist. I take pictures and sell them for money. Sometimes I write up stories." There, an implied line is better than a spoken line. In rural hamlets like this, hope always springs up, like desert flowers after the first spring rains.

Emma glanced back at Cook, who still read her paper, then back to him, one hand resting on her hip. She tilted her head to the side, like a bird does while inspecting a tree bark crevice for its insect breakfast. "Where from?"

"Los Angeles. Riverside, actually. To the east of downtown LA."

Emma shook her head. "Too many people in places like that for me. You want coffee with your pie?"

Damn. He was going to lose her. And with the mystery of the road sign still unresolved. He stuck a fork in the pie, but held on to eye contact. "Maybe later. Hey—you know anything about the road crews that put out the highway signs?"

Emma leaned back against the rim of a nearby tabletop, crossing her arms and relaxing as if she had nothing better to do. Or perhaps . . . perhaps being friendly with an out of town stranger was normal here. No

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one had asked his name yet. Emma hadn't bugged him about cash money. Emma smiled easily.

"Some. Janie's boyfriend Joe works for them sometimes. When he's not doing seasonal work on a Forest Service fire crew. What'cha want to know?"

"There's a funny road sign a few miles north of here."

"Funny?" Silvery-gray eyes sharpened.

He shrugged, enjoying the cool shadows of the cafe, the woman's feminine presence, the smell of the cooling pie as vanilla ice cream melted into creamy white pools on either side, even the studied indifference of Cook. The spring-tight nerves he'd had ever since blowing most of his cash in Gallup to fix a dead radiator eased a bit. "Yeah. The litter control signs. You know them?"

Emma looked away, eyes going momentarily distant; when she looked back, the friendly smile seemed guarded. "Sure. The County puts them out. Mary Alice over in Public Works orders them up from some sheet metal shop down in Silver City. So?"

"The one north of town said something crazy. It said—*Litter Control. Next 3 Million Miles. Uncle Jack's Home for Retired Space Beings.*" He grinned, feeling boyishly foolish at saying something so silly. Emma didn't smile.

"*Jack's* Home? Oh." False front surmise filled her windburned face. "Hey. Someone's messing with Mary Alice. Jack runs a dude ranch east of town, off a dirt track going up to Eagle Peak."

No aliens. No space beings. Just some summer camp for yuppies who liked to ride horses, use an outhouse, and go back home to brag about how they'd "roughed it"—once. Unlike the people who lived it day in and day out. Like his grandpa. Still . . . money was money. Truth didn't matter all that much. Another overseas lesson. "How do I get there?"

Emma grimaced. "You got four-wheel drive in that jalopy? No? I thought not. You'll bottom out on the road up to Jack's place."

"I take pictures. I can always take pictures of the mountain and Jack's place. Maybe write a story. Help him out."

"He don't like visitors."

"But it's a dude ranch. For tourists. You said so."

She blinked, looking suddenly tired. "Look. I got a cafe to run and a teenage daughter to feed and clothe all by myself. I'll bring your coffee." She stood up.

"Emma."

"Yeah?" she called back his way as she walked past Cook to the kitchen's open doorway.

"I'm Bill."

"Your coffee's coming right up, Bill."

Silence. Cook read on. The cool shadows deepened. The country music moaned. Finally, all he could do was eat the pie, slurp up the melted ice cream, drink the coffee, and wish he were back home with Davy. Him and Davy. All that was left.

Small towns weren't supposed to be so lonely.

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* * *

The gas station attendant's rough-scrawled map to Jack's place didn't match anything he saw after he turned off county road 435 and crossed the San Francisco River. Then he'd gone stupid. Leaving the green-grassed valley that stretched south to San Francisco Plaza and Lower Plaza for the windy, narrow Forest Service dirt track that led deep into the high ponderosa groves of Gila National Forest had been stupid. Continuing on even after he high-centered and lost his muffler was criminal. Still, he'd always been stubborn. Before he'd lost hope.

A fork in the road loomed in the late afternoon sunlight. To the right it opened out into a high mountain meadow; weathered wood buildings shimmered in the distance. To the left it disappeared into the ponderosas, heading vaguely east, towards the high purple-red rock of Eagle Peak. The map indicated a right-hand turn. He turned right.

Nothing but an old mining ghost town. Only the wind still argued about stolen claims. He turned back, driving carefully to avoid the sharp-edged rocks exposed by late spring rains. Nobody had been up here to grade the road in a long time.

The fork.

It would be dark in a few hours. He had a photo shoot already set up in Silver City. Some kind of gamblers mecca place that would open soon, and the owner wanted national travel magazine exposure. Which was why he'd advanced Bill gas money. Still, he didn't like being put off by country bumpkins.

He turned right at the fork, heading up a dirt track that showed deeper rutting than the ghost town track.

Two miles. Another mountain meadow. Four miles. A dense ponderosa forest. Six miles, and his car nosed out slowly into a wide clearing. A clearing that lay pristine, natural and heart-aching beautiful just below a sheer cliff face. Above the cliff ran a sawtooth ridgeline, angling left, towards still distant Eagle Peak. Down below, to one side of the clearing, stood a two-story lodge made from rough-sawn planks, notched logs, and scavenged windows. Stately ponderosas flanked the lodge, while a dozen or so log cabins hid among a scatter of other ponderosas, their green-topped crowns swaying lazily ninety, a hundred feet high overhead. Big trees. A lone Suzuki jeep with ripped out seat cushions lounged in front of the lodge. Somewhere, horses neighed, maybe in the barn he now saw lying on the other side of the clearing, next to a broken down corral.

Some dude ranch.

He stopped by the jeep, got out, took the lens cover off his camera, stepped onto the open porch, and walked up to the lodge's front door. The interior of the place stood open, only a rickety screen door preventing the entry of anything larger than a mongrel dog. He knocked on the door frame. It banged loosely.

"Hello? Jack? Is Jack around?"

Footsteps sounded inside. Off to his left, among the weathered cabins, something moved. "Hello?" He turned.

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Something yellow, sheetlike and very fast moved around a cabin corner, disappearing from his peripheral vision before he could focus on it.

The screen door opened outward, forcing him to step back. An older man looked at him. The uncle of the Marlboro Man. Shit. Even down to the scratched cowboy boots, leather vest, heavily washed lumberjack shirt, and crow's feet around stark blue eyes. But the six-shot revolver hanging from his narrow hips was not some advertising image. It was real. Real like the gray in the man's handlebar mustache. He looked surprised at finding a visitor on his front stoop.

"Hello yourself. Who are you?"

"Bill Johnson. I'm a photojournalist from LA." No reaction. "Emma said you ran a dude ranch. That true?"

The man rubbed his freshly-shaven chin. "Used to. Not anymore. I'm retired."

"You Uncle Jack?"

The man crossed his arms, leaned against the doorframe, and eyed Bill with a sardonic skepticism that seemed reserved for officious, nosy outsiders who didn't understand the rules of country privacy. "Maybe. Who's asking?"

Damn. He was already late and this character wanted to play games. "Hey. I'm not IRS. I don't give a damn if you work on the side to supplement your social security. I just wanted to know if . . . if this was Uncle Jack's place."

He nodded courtly-like. "I'm Jack. Been here thirty years this Sunday. What brings you up this way? That car of yours looks dead beat up. It's not smart to chance a city car on our back roads."

Roads? What a laugh. But he didn't. He just stood there, camera dangling from his neck, afternoon wind picking up and cooling things off a bit after the warm Sun of the day. He felt stupid and foolish. "I saw a road sign north of Reserve." Jack waited patiently, eyes twinkling. "I know it's probably some practical joke, but I took a picture of it anyway."

"What kind of sign?"

He searched the old man's sunburned face, wondering if he were the only living being in this place of high mountain silence. "A litter control sign." Jack's casual manner sharpened a bit. "It said—*Litter Control. Next 3 Million Miles. Uncle Jack's Home for Retired Space Beings.*"

Jack laughed. Loudly. "You really *are* from the city." His laugh ran down slow like, kind of the way a car's fuel line clogs up, a sputtery stop-and-go kind of laughing that finally sighed away into the wind. "You believe everything you read?"

His face burned. "Nope. Not since the Gulf War."

Jack's bluff good humor slowly sobered. "Oh. Were you in combat?"

"Nope. Just took a lot of photos. Pictures. For magazines. Newspapers. The usual war stuff."

Jack looked confused. "Then why do you seem so—"

"Forget it." He turned to leave, raising the camera to take a few scenery shots. Maybe he could sell them to some RV magazine. "I just saw a stupid sign that reminded me of something. But Emma's right. It's gotta be

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someone playing a practical joke on you."

The camera snapped. He thumbed the take-up lever, enjoying the physical feel of doing something for himself, rather than relying on the electronics of the newer cameras. You could really only rely on yourself. That's what he'd learned during the divorce. The abandonment. And especially when he'd come home to an empty house after Elaine's funeral. No one left but Davy, and he'd chosen to stay the night with some high school friend. A rarely seen father offers less comfort than a friend who's there for you day and night, year in and year out. Jack scuffed boots behind him.

"Well, uh, if you say—"

Something long, low and beetle-like skittered between two cabins, keeping to the late afternoon shadows. His camera snapped automatically. His eyes refused to believe what he'd just seen. Naw. Had to be the waning light. The last time he'd seen a human-sized cockroach was when he'd read an illustrated edition of Kafka's *Metamorphosis*. He stopped by the car as Jack finished talking.

"—Say so, then go on back to Reserve. But watch out for that drop down to San Francisco Plaza. You can lose traction in the loose dust."

He looked back at Uncle Jack. The man's eyes seemed to be having trouble focusing on him. They would look away suddenly, to the side or beyond Bill, to something behind him. The cabins? He turned and looked.

Cockroach stood upright in the fall sunlight, looking at him.

Dizziness hit. Hard. Like when you don't eat for a day. Or when you're dehydrated. Or when you have a high fever. That kind of delirious dizziness.

But he'd just eaten. Drunk enough coffee to make him want to pee. And there was nothing wrong with his Army tested eyesight.

Cockroach eyed him. Curiosity shone forth, along with a sense of a fuss budget family servant, a retainer put out to pasture after a lifetime of loyal service.

Shit.

He wasn't really a cockroach. The eyes were something weird, like two blue saucers that seemed deep as an ocean. What he'd thought were antennae were actually long strands of something silky, resembling hair. And the insect-like body of brown chitin plates seemed less rigid than on first glance. More like a very tight-fitting winter suit. But whatever it—he—was, he possessed two weirdly jointed legs and four articulated arms that ended in slim, prehensile digits. Digits that resembled fingers. As much as the eyes resembled human eyes.

Jack coughed.

"Captain Twixell, that's enough. You're scaring him."

Cockroach turned his attention to Jack, now standing beside Bill with a warm, comforting hand on his shoulder. A *human* hand. His shakes died away just as he realized he'd had them.

Sound screeched. Captain Twixell the Cockroach turned and ambled away through the ponderosas, heading for the horse barn. Slowly, like a

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tree falling to a lumberjack's saw, he turned and faced Uncle Jack.

"That sign was no joke. Was it?"

Jack still held his shoulder in a firm grip. But a friendly grip. Like the way his grandpa had shaken hands with him that summer he'd spent on the family farm outside of Houston, long, long years ago. Jack's mustache wiggled as he spoke, wryly. "You're taking this well."

"Well? It's not the first time I've seen crazy things. But usually I've gone through a quart of Jim Beam."

Jack sighed. "Come inside. You look like you need to sit down."

They went inside, into shadows. Past a Victorian-style sitting room up front, all fitted out with highbacked sofas, a baby grand piano, several bookcases stuffed with books lacking the dust of disuse, and old black and white photographs. Antique portrait photos of frontier men and women stared down from the wood plank walls. Even a Zuni, Hopi and a Navajo or two looked down from their own frames, somber as the Anglos. Too many people to be Jack's grandparents.

Down a long hallway, and past stairs going up to the second floor, lay the kitchen. Jack sat him down, then offered iced tea pulled from a twenty year-old refrigerator that had never seen a hungry teenager. Or an icemaker. Jack got out two glasses, poured, set the pitcher down on the counter, and put a chilled tumbler of rawhide-colored liquid in front of Bill, keeping one for himself.

"Bill, you feeling all right?"

"Huh?" He looked up as Jack sat down across from him, legs stretched out to rest work-worn boots on a handmade split-pine chair. Honest sympathy shone in Jack's face. "Yeah." He sipped the iced tea, putting it down when the shakes returned. Very carefully. Very exactly. Like a helicopter coming into a hot LZ pad, he navigated the water-dewed bottom of the glass down to its nexus with a polished burl wood table top. A slice of wood from a tree that had to have been three hundred years old. Handmade. Like a lot of the stuff on the hallway walls and in the simple kitchen. He licked dry lips. "Jack, what the hell's going on here?"

Jack sighed, long, low and musingly. Bushy eyebrows almost hid the man's lake-blue eyes. "Nothing. Nothing at all. You go on back home to LA and forget all about this. Nobody'd believe you, anyway."

Stubborness welled up. Along with something else. "I've got pictures. Photos don't lie."

Jack laughed gruffly. "Bullshit. Digitized photo images can be morphed so they'll show Joe Stalin humping Marilyn Monroe. Don't you keep up on your own field?"

What the hell? "So what! Get a TV news crew out here with a satcom dish and remote broadcast van, and they'll believe."

Jack shrugged, sipped his iced tea, and mumbled "If they *want* to believe."

Overhead came the sound of steps. Not *foot*steps. But steps. Jack winced. "Damn. Told her to stay in her room."

"Who?"

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In the hallway behind him, the aged stairs creaked as wood shifted to a tread totally lacking the pacing of normal humans. People. He swallowed hard, focusing on Uncle Jack. "Who, Jack?

Jack looked sour, glancing behind Bill as the *steps* walked right up to and then stopped behind Bill's chair. "Captain Siane, that's who. She's a nosy bitch who won't follow anyone's rules."

"Rules are for those still working by the rules," murmured a voice like a waterfall. Bill turned, wishing, *hoping* this was all a dehydrated dream where he'd wake up late at night, beside his broken down jalopy, stuck in a rut high on some New Mexico mountain road that lacked people but still echoed to the sound of *normal* things. Like birds, insects, pine squirrels and the wind. He looked up.

She.

He saw no breasts. Nothing mammalian at all about this woman. But very feminine. Very earth-motherish. Not pinched like Linda. Open. Expansive. Considering. Her eyes were the best part. The normal part.

Two sandy brown eyes watched him from a thin elfin face, looking down from an impossibly tall, slender frame that was humanoid—as much as he could tell under the camouflaging jeans and cotton work shirt. The clothes had been adapted from some ranchwoman's work clothes, but two feet of raw cloth had been added on. Folded hands lay clasped where a waist should be. And probably was. The tea spilled noisily as his hand jerked back, clutching, seeking something normal. Regular. Human-like. Anything but this . . . this. . . .

"Oh, goddd. . . ."

"Which one?" asked the alien woman, a beautiful smile filling her face, much like a Seurat pointillist painting will suggest a shape without the use of straight lines.

"Uh. . . ."

Jack coughed irritatedly. "Captain Siane, you know the rules of the Refuge. Why the hell are you scaring the shit out of this poor outsider?"

Siane turned her gaze from Bill. He slumped in the chair, heart thumping wildly. Her gaze on him had been like a mongoose eyeing a snake. Had he been prey? Or just a curiosity? "Uncle Jack, your rules are extreme. The townspeople don't mind us."

Us? He turned back to Jack as Captain Siane regally rounded the table and leaned back against the kitchen counter, where she could watch them both. Jack pulled out a pen knife and started trimming his nails, not looking at her. "Rules are obeyed by *polite* people. Even if they disagree with them."

He swung his head back and forth between the two of them, unable to believe the inanity of their conversation. Aliens were *here,* on Earth! Major news. Major photos. Big money. Money enough for him and Davy to—

Siane looked his way sharply. "Bill? You're the Bill who talked to Emma, aren't you?"

He gulped. "Jack. Uncle Jack. Does she read minds?"

Jack and Siane both laughed hilariously, clutching their stomachs. He simmered. "Hey. There's no phone

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lines to this place. It was a serious question."

Jack shook his head, bemused now that Siane wasn't arguing with him. "CB," he said.

"Ceebee?"

The hand with the pen knife jerked one thumb back to the white porcelain kitchen sink. Beside it sat a squarish lump of plastic and metal that blinked a few lights and sported a whip antenna. The kind you see on rural pickups. Oh. He understood now. Citizens band radio. Out here, in the rural West, CBs went with pickups and gun racks in the back window the same way a BLT sandwich always had three ingredients. Pickup, gun, and CB. All the locals had them.

"Emma called you?" he asked as Siane watched them both intently.

"Of course. As did Hank at the gas station. We're not country bumpkins around here, you know."

He didn't know. And he'd made some stupid assumptions. He shook his head, cycling back to two things not made in Detroit or Tokyo. "Her. Cockroach man. Where the hell are they from, and why haven't they . . . haven't they. . . ." Siane seemed amused by his stumbling over the hackneyed words usually contained in five buck sci fi thrillers.

"Why haven't we done *The Day The Earth Stood Still* number?" she asked.

He nodded, numb. "You watch TV reruns too?"

Siane assumed a very serious manner; almost a command manner, much like that belonging to a general commanding an armored division who worried about the people inside his expensive hardware. "Only when I'm bored. But in space, nothing is ever lost. Even old films." She smiled quirkily. "Sorry. No residuals for retired screen writers. It's a bit hard to tax empty vacuum."

Warmth flushed his face. Dimly, he realized he was about to faint. He'd been hyperventilating. Cold liquid splashed his face. Jack put down his empty tea glass, eyes angry as he turned on his boarder.

"Siane! Leave him alone. And don't play mysterious with him. He deserves politeness just like anyone else around here."

She fixed hard, hard eyes on Uncle Jack. "So? No one asked him to come up here. No one asked him to invade Captain Twixell's afternoon constitutional. And no one invited him to feel lustful emotions about Emma. I like her and Janie. They don't need jerks like this guy bothering them."

He? A jerk? But how had she known? Jack slammed a fist on the table, really angry with Siane. "Captain! Now he's all worried again." Siane simmered, not giving ground. Jack turned to him, handing over a towel for his face. He wiped. Jack reined in his temper and talked reasonably. Normally. "Bill, she isn't a telepath. But she *is* a nosy bitch who can never refrain from taking an empath reading on anyone who comes visiting." Empath? His confusion showed. Jack growled, eyeing Siane again. "See? Bill, she just picks up on emotions. That's all. Some humans are like that too. So rest easy."

Rest easy? Hysteria died before cold

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anger. "Bullshit. You've got two kinds of aliens here. Maybe a third. I saw something sheetlike when I drove in." Jack buried his face in his hands, melodramatically sorrowful. It was an act. He could see that now. "Truth. Time for truth now. Who put up that sign? And why the hell is *she* here?" His gesture seemed to insult Siane, who stared at him intently, a harpy looming in the corner of his eye.

Uncle Jack sat back, suddenly calm, all the country rube act now vanished from his leathery brown face. "Truth? You think you can handle the truth?"

"Yes."

Jack glanced to Siane. She looked surprised, but nodded absently, still watching him. Maybe seeing more than a jerk. Jack shrugged, then leaned forward with elbows on the table, all business. "OK. Maybe you can. The highway sign tells the honest to god truth. But it shouldn't have been worded that way. I guess Captain Gecko likes practical jokes."

"Gecko? A joker?"

"The yellow sheet you saw flitting among the trees. That's how he moves. Sailing the wind like he used to sail the long depths between the stars." Jack paused, gaze going distant, not focused on him anymore, or on the wallpaper or the fridge or anything earthbound. "This is the Refuge. It's been here since long before the Hopis, Zunis, Keresan and others moved up from northern Mexico to settle this country. About two thousand years ago. Something like this place has been here that long. Maybe an adobe mud building. Maybe a stone building. Since the Pueblo Revolt and the arrival of iron tools, saws, nails and basic technology, they've allowed real buildings." Jack glanced aside at watchful Siane; her luminous brown eyes seemed indrawn too, remembering. "Bill, you ever been to Florida?"

"Once."

"What's the average age of people down there?"

"Old. Lots of—"

"Retired folks. Right. Same here. Same reason." Jack laughed musingly, eyes still somewhere else. "Pensions buy more on Earth. And this is a good place for an old age retirement home."

"For *whom?*" he croaked out, disbelieving.

Jack focused back on him. "For retired starship captains. Who else? Though with the AIs running the ships and offloading the cargos, they really don't have much to captain. Just themselves, a few crew, the gardens. They have lots of time on their hands. No hyperdrive where they come from, just standard old sublight starships. Nothing fancy, gets you from here to there." Jack looked up at Siane, sadness showing. "Takes a few centuries though." Siane looked away from them both. Wetness showed around her eyes.

Centuries? Aliens hidden in the New Mexico back country since before the Spaniards got their butts kicked back in 1680 by the united Pueblos? The Keresan, Hopis and Zunis were agricultural folks who'd grown corn, beans and squash as good as any Anglo farmers. They'd built great pueblo towns out of adobe

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mudbrick, stone and wood, made exquisite pottery, and still worshiped kachinas, the Corn Goddess, Coyote, and a few other beings with not the slightest resemblance to standard Judeo-Christian theology. But he was wandering. He looked back to Jack.

"So this really *is* Uncle Jack's Home for Retired Space Beings?"

"Yep."

"Then why the highway sign? Are you saying these . . . these aliens walk along the roadside just like us, picking up litter? Old pop cans? Paper trash. Stuff like that?"

Jack eyed him seriously. Totally serious. Much like Emma had, except she'd been less patient. Maybe she'd seen his kind of come-on once too often. "Sure. Why not?"

Why not indeed? "But that means—"

"That means everyone in Reserve knows about them," Jack said amiably. Lazily, he reached back, refilled his glass from the iced tea pitcher by the sink, sipped, and put the glass down. He looked up, face now judgmental. "Bill, you ever done civic duty? Been a volunteer fireman? Collected cans for a food bank money drive? Done anything for anyone else but yourself?"

Siane watched him even more intently than Jack. Her slick black hair stirred to hidden skin movements. Jack's mustache twitched. "A few times. Before my daughter died. Before my divorce. Now, I'm just trying to make a few bucks. To take care of my boy. Davy."

Siane sighed. Like a waterfall talking to a mountain meadow, speaking in tongues known only to the boulders, the wind, the moss and those who sleep unafraid among the stars. "We just want to *belong,"* she said, her voice slicing into scarred areas he'd hidden away after Elaine died from a smack-laced crackball, courtesy of her jerkoff gang boyfriend.

He turned to Jack, wanting to believe, but afraid. "And no one *tells?"*

Jack blinked owlishly. "Out here, people mind their own business. If someone pays their bills, honors their word, says hi on the street, and acts neighborly, that's enough. Neighbors are few and far between out here. Especially *good* neighbors. The kind you can rely on for help putting out a brush fire before it burns down your house." He looked aside at Siane. "Go on outside and tell the others they can come out of the cabins. Either he'll tell, or he won't."

Siane left, her inhuman steps moving delicately, calmly down the hallway. The front screen flapped open, then banged shut. Steps receded into the treeline, finally vanishing as the rising wind of early evening creaked high branches. He looked back to Uncle Jack.

"Why you?"

"Why me what?" Gruff guardedness returned to the man.

"Jack, why do you stay here? Why not . . . get a life. Elsewhere."

Pain etched Jack's clean-shaven cheeks. Along with pride. "Ellie's dead. Long dead. And it's kind of like an inheritance. This place. Family honor and all that. Most city people don't understand."

Understand what? That there was

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more to life than just money? That loneliness was the great universal? Maybe his grandpa had left him something more than wistful memories.

"And litter control? They really do that?"

Jack grinned, boyish despite his years. "Sure. But only for three miles north and south of town. And only at night, so they don't frighten the children. It's their civic duty. Makes them feel like they *belong*. Bill, they're lonely. They're tired. They have no home to go back to—it's all lost in time. And we're off the beaten path. Far off." Jack stood up abruptly; his empty glass clinked as he put it in the sink, cleaning up. Like you do when sharing a kitchen with someone else. "It's all about *community*, Bill. Do you understand?"

He stood up, shakes gone. "But they're so different."

Jack followed him out to the front porch. "You think so?"

They stood on the porch just as the Sun's honey yellow globe dipped below the western ridges of the Tularosas, easing the harsh brightness of day, and bathing *Uncle Jack's Home for Retired Space Beings* in an amber glow. In that glow, retirees relaxed on cabin porches, tossed Frisbees to each other, rode a skittish horse, or just stood close by a tree, eyes—if they had them—closed tight as they hugged its rough bark, tasting naturalness after eons spent between cold metal walls, accompanied only by long-lost memories. Among the trees, Captain Siane walked hand in hand with Captain Twixell, she tall, young and vigorous, he looking a bit stooped, a bit creaky in the joints, an air of weariness hanging over him like a familiar storm cloud. Siane's slim back stiffened, as if she sensed his feelings. She didn't look back. She just walked on into the cool twilight of a high mountain forest in the backcountry of New Mexico, a place lost in time, a sere, primal landscape lying west of the Trinity Site, north of the Mogollon Rim, east of the Blue Range Primitive Area, and south of ancient Amerindian peoples. People who perhaps had once felt as Jack did. Sympathetic. Neighborly. Without pity. And accepting.

Jack opened his car door for him. He got in, laid the camera on the seat beside him, put the key in the ignition, and looked up at Jack. Jack with his revolver still in its worn holster.

"You're not going to keep me here?"

"We're not that kind of people. Nor are they."

What about Reserve? Maybe someone would talk. For money? For security? For the illusion of fame? "You could take my camera. Destroy the pictures. No proof."

Jack smiled easily. Honestly. Still the Marlboro Man's grizzled uncle, but an honest uncle. Not someone putting on a show for a stranger he hoped to fast-shuffle off, convinced he'd seen hallucinations brought on by salt deprivation and thirst. "The good people don't demand proof. Nor do they invade someone's privacy without good cause. Siane trusts you. Even Emma thought you had a spark of something in you despite your New York manners. Prove us

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right."

He drove off.

Down the mountain. Across the river. Back through laid-back, deeply shadowed Reserve, where strange neighbors walked the night. Then left down State Highway 12, on the way south to its intersection with U.S. 180 and the long night drive down out of the mountains and into Silver City, a place of bright lights and fast money perched where desert meets mountain. Only the harsh engine sputter kept him company—but a lost muffler was the last thing on his mind.

Two miles south of Reserve, the two-lane highway shimmered mirage-like in the blue-black night, a darkness deep enough to require headlights. Twin yellow beams speared out, bathing the road in cones of cold light. Pine sap scent seeped in on the night air as he drove slowly, lazily, turning over the day's events the way he used to play with crawdads at his grandpa's farm outside Houston. In the country, beside a drainage ditch filled with rain from some sudden thunderstorm. He'd sit on the footbridge over the ditch, and lean over, dangling his four-year-old fingers in the warm, sluggish waters, fishing for a denizen of the deep.

Every time he caught a crawdad he'd squeal excitedly. No one around to hear. No matter. It had happened. He'd touched something *alive*. Something real. Something that shared the world with him and stared back at him with beady eyes on little stalks, impatient to be put back in the ditch water, where it would continue serenely on about its business. But not angry.

He was, after all, a neighbor.

Something flashed in the headlights up ahead. Something yellow, sheet-like and nearly translucent.

Captain Gecko.

Along the roadside, hidden by the evening darkness, there flew a mustard-yellow bedsheet without head, eyes, limbs or any anger, a sheet with a taste for practical jokes.

Dipping, it curved down, touched the roadside with something not like fingers, then soared up on the evening wind, maintaining a glide-path about five feet off the ground, searching carefully.

Litter patrol.

As he passed Captain Gecko, he recognized a squashed pop can gripped tightly in translucent flesh, destined for some distant garbage bin.

——Davy. And him. That was all that was left of his family. But . . . but maybe Emma's daughter would like Davy's rangy good nature. Maybe Davy would like a place without the gangs and the drugs that had taken his sister. And maybe he and Emma. . . .

He grinned. "Bullshit."

He was too old for romance.

Especially around aliens who could read your emotions.

But a good neighbor who served home-made, fresh-baked apple pie to snotty strangers and still managed to find the promise in each of them, hey, that kind of neighbor he could like. Maybe she would like him. Maybe not. He'd taken chances before.

Keeping one hand on the steering wheel, he fumbled in the darkness, found the camera, popped the film

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spool lock, opened the back, and pulled out the exposed film. It fluttered in the sultry fall wind, whispering unknown messages to pine scent, squirrel chatter and mountain dreams. He didn't care. A little mystery never hurt the world.

He tossed the film out of the car window, aiming for the roadside.

Where Captain Gecko would soon pass.

Couldn't be a litter bug, could he, without trashing the countryside? Maybe, when he returned, the litter patrol would arrest him for littering.

He hoped so. □

IN TIMES TO COME

A few years back we published a story called "Floodtide" by Ben Bova, the descendants of which have since become the popular "Orion" series. Most of them have not appeared in *Analog* because they were set in the far past and tended to look like fantasy—but remember Clarke's Law! Next month we begin a four-part serial, *Orion Among the Stars*, in which Orion's adventures move into the far future and clearly science-fictional territory, where Clarke's Law (or is it the inverse of Clarke's Law?) is in full force. It should be the perfect response to readers who have wished for more "old-fashioned space opera." It also sheds fresh light on some favorite science-fictional questions such as the nature and plight of the ultimate soldier—and the ultimate draftee—and a seldom-mentioned flaw in a certain concept of immortality. . . .

G. Harry Stine's fact article bears the slightly cryptic title "Great Circles and Spaceships, or, Where Is The Center of the World?" A crucial element in the development of a space industry is what *else* you can do with a spaceship, and that has a direct bearing on where you put a spaceport. . . .

And, of course, we'll have a variety of short fiction by writers including Mary Caraker, Michael McCollum, and Jerry Oltion.

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Mark Rich

IMPOSSIBLE ALONE

There's more than one way. . .

Illustration by Randy Asplund-Faith

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The most powerful person in the Solar System cadged a drink off me.

"Simon!" I said. Even on a low budget myself I willingly pulled out a ten to cover the next round. "What's it been, sixteen, seventeen years?"

"That many?"

"You skipped that last cluster reunion."

We graduated a year apart in the late nineties from Beloit, me with a degree in biochemistry that led to cell work on amphibians, he with a combined degree in physics and chemistry that led him on a zig-zag course after several higher degrees from MIT: first a NASA lackey, second a consultant for several top contractors, and then head of one of the largest aerospace companies on the globe, Kunz, with reputedly as many assets in Russia and China as in the U.S.

He nodded acquiescence. "So I did."

"So what's up for the trillionaire these days?" I hatched in my head a dozen leading questions—not that I wanted to take advantage of an old friend, but out of honest curiosity—I *think* it was honest—as to whether Kunz Corp had a philanthropic arm that would help fund *my* area of research.

He shook his head. "So people still think I'm a trillionaire."

"Well, sure. You are, aren't you?"

"I suppose it looks like it on paper, if you hold the paper upside down."

"But don't you have a center down in Sarasota you built only a few years back? And someplace up in Norway?"

He nodded. "But it means nothing, Bob. If I went the way you did—I mean, you're still scrambling for grants, aren't you? And living off an academic salary part of the year? If I did it your way I'd be better off now. Hell of a lot better."

"But these buildings, whole industries at your beck and call—"

"When you have massive debt, you can always go deeper. And deeper. And deeper. Debt's the only bottomless pit."

I looked at the beer in front of him, bought with my five bucks, with new understanding. It also finally registered that this was no classy hotel in whose bar we happened to find each other. My presence indicated as much.

"You're broke?" I said. I imagined reading the information in alumni news and decided it would never happen. The alumni editor put a bright cast on everything.

"Technically, no. In real money terms, absolutely."

"My god, what happened?"

"I'm not sure I should say."

"Come on, fess up. Give me a capsule version at least."

"Capsule version? It *still* won't be easy for you to swallow, I bet. But I'll tell you this much. You know the collapse of efforts to get out of our gravity well? I don't mean stuff to the Moon. *That's* all nearby stuff, and money's pouring into that like it won't stop. I mean efforts to get away from here. Venus. Mars. Especially Mars."

"You were big into Mars."

"Kunz Corp *was* Mars. Nothing else. I piled everything into it. Absolutely everything. I took a bet."

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"And lost."

"Lost big. The States pulled out when Congress hogtied NASA and Sands Offplanet into the Moon junkets. And when the States pulled out, Global Spacenet sucked in its gut and looked to the Moon, too. Sure, I could use what I have for Moon work. But all the long-range stuff we'd developed—kaplooey! We have a couple trillion in hardware sitting in Florida. Rocket technology, life-support technology, radiation-shielding technology. *My* couple trillion. It's all wrapped up in stuff we can't use. But that's the nature of the gamble, isn't it? It wouldn't be the future if we could predict it."

"But what about the new businesses of the last few years?" I'd heard about something having to do with biotech.

"That's longer ago than a few years, Bob." He gave me an odd smile, then shrugged. "I'm pretty much a sunk boat, unless this Green Spot stuff makes people force Congress's hand."

I thought about it. "It would take that, wouldn't it? Public mandate, that kind of thing?"

He nodded.

The Green Spot had become big news the year before: an area of anomalous coloration had appeared on the surface of the Red Planet adjoining one of the polar caps. It had grown appreciably in the time since its discovery. The latest of the Observer series inconveniently went haywire, as did the prior one, meaning that the best near-space photos came from Earth-orbit and Moon-based telescopes—good images, it was true, but not good enough.

The images agreed in one respect, at least: that the Green Spot looked tantalizingly like evidence of plants. Life.

"It sounds like there could be a quick reversal of public opinion, the way the tabloids are going," I said. "Life on Mars. That's all it takes, isn't it, to get people furious to have manned exploration?"

He shrugged. "I'm hoping. Believe me, I'm hoping."

He asked about my current project. Somehow we passed the next couple hours talking about that. He even showed a fair grasp of some of the topics I've been tackling, which helped, and which made me wonder exactly how far he had gotten into biotech.

My main concern has to do with ecostrophism. While it isn't a word people use everyday, it preoccupies me a great deal.

Ecostrophism refers to the influence an organism has on environment: literally, it's the measure of how "home-turning" an organism is. Every living thing "turns" its home from what it was, making it into a new thing, a new place, a new environment. Corals *make* atolls into the fantastically rich biotic regions they are. Grasses make the plains what they are. Voles and mice dig tunnels in the grasses, opening new pathways for snakes and insects; beetles leave droppings fed upon by bacteria; fungi in the soil make it possible for a seed to germinate, the plant which makes an environment suitable for a set of

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moths and butterflies to propagate, which in turn makes it an environment more suitable for birds and bats. The world turns and turns. Everything affects everything else.

Humanity tends to be more ecostrophic than most species, it's true; and technological humanity gets carried away with it the same way humanity gets carried away about all things. To mention just one minor indicator of this: the neologism "ecotastrophe" entered the language long before the more useful term "ecostrophism" did.

My difficulty lies with choices. How far should we exert this ecostrophism, once we realize that all our actions have implications within the "natural" world? My particular area of study has led to a development potentially of great importance to all amphibious life of the planet, with the possible exception of some legless and purely aquatic forms that rarely see direct sunlight.

I have engineered the better frog.

I should say I engineered the better frog *skin*. Frog populations dropped drastically the last two decades of the Twentieth, in part due to pollutants and in part to ozone decrease. Unscreened sunshine fries the tender-skinned animals, at least it does when flushes of acidic snowmelt in spring haven't already kept the tadpoles from maturing into adults. A better skin seemed in order, one that would deal better with the Sun—reptiles had learned that trick long ago, and thrived in niches shared only with periodically appearing toads—and better with pollutants, too, if possible.

Once I had the skin, though, the question became *which* amphibia should I help? And where? And should I do it at all? It became not a question of whether I should try to save amphibians—the answer to that being an unequivocal Yes—but whether I should risk entire *ecosystems*. I was pondering the introduction of an unknown factor into some of the most delicate ecosystems known to humankind—limpid freshwater pools. How could I do it?

"I understand your dilemma," Simon Kunz said. "Though I come at it from a different angle. I'm into the exploration of planets. Think of that, Bob. Think of an entire planet. From our point of view, it's pristine. Pristine, that is, until we land a craft there, burn it with rocket flames on descent, walk all over it, and presumably leave monitoring machines behind us and some trash, too. We expel gas, we lose water vapor. Inevitably we leave bacteria. Think about that planet Mars. How do we go about its exploration when we *know* that the very act of exploration will irrevocably change the planet we're exploring? It's a toss-up, is what it is. We have to decide one way or the other. Either we commit ourselves to going no nearer the planet than orbit, or else we commit ourselves to change, and accept the fact we're never going to have a pristine planet again. And if we take that step, who's to say when we stop? What's going to keep us from going *all* the way? What's going to stop us from changing the atmosphere, the landforms, the chemistry—in short, altering, or else

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creating, a whole planetary ecosystem?"

"Which way do *you* lean?"

"Frankly, I'm an all-the-way kind of guy. I wouldn't be where I am—well, that's not saying much, but I wouldn't have gotten where I did in the space programs of three countries on two continents if I wasn't into messing with the Universe. I figure we'll go to Mars and change it radically. We're going to make it a human habitat if it isn't a habitat for something else already. We're going to make it a place to *live*."

I would have cause to remember those words.

Across the newsholo's front page, full-screen, some ten or so days later: GREEN "SPOT" GROWS, MAKES RING AROUND POLE: MARS ALIVE? "The ring has blobs and other features, new photos reveal. See details Page 3 Down."

A blurry holo next to the headline showed, indeed, blobs and other features.

I remembered the headline from a tabloid only the day before: "Martian Canals Will Reappear This Month, Scientists Say." I nearly bought it.

Less happy news arrived on the Newsprint Local, with an obituary of O. Howard Luntes, industrialist, benefactor of the Great Lakes Area Freshwater Task Force, and past trustee of Nettleridge Community College. I could count on no more assistance from that quarter, presumably. The Dean mailed me a note about one of my classes, moreover. A cancellation. "Enough students signed up," she said, "but we had to cut somewhere and the axe is coming down in the part-time staff. That's been an unprofitable part of our operation this last quarter. Sorry, Bob, I tried to save this one." Thank *you*, Jean. Better news from Sandy, who was off visiting home: "Mom's better," she said, "and I bought her a new dress. One for me, too. Love and kisses, and a bill, enclosed."

The same day, mid-afternoon, an ambiguous express package apparently arrived at my office at the college. I say apparently because I was at home that evening when the phone call telling me about it came via secure line.

"Hello, Bob?" he said. Even without the vidline activated—part of the security process, I supposed—I knew his voice.

"Didn't expect to be hearing from you," I said. I only spoke the truth. I figured to run into Simon Kunz in another decade, after he spent his way through another fortune on space and I had fruitlessly hit up another zillion blank-faced benefactors for funding frog skin research.

"Did you get the stuff?" he said.

"*What* stuff?"

"I didn't have your home address. Or someone didn't. I don't know. I'm just in charge of this place. They must have sent it to the college. You're still at Nettleridge, right?"

I thought of the canceled classes: two last year, one so far this year. "Sure."

"I sent a plane ticket there. It must be at your office. I want to talk to you. Can you catch the flight? It's going

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out tonight."

"Tonight? My god, Simon, what are you talking about? It's after six!"

"You're doing fine," Simon said. "Plane's not till nine. Go pick up the ticket and I'll meet you at the airport at midnight."

"You're crazy!"

"Sure I am. See you later!"

"Wait, wait—why not just talk to me on the phone. I mean, I'm here, and you've got me. Talk. Tell me what's going on."

His silence told me he wouldn't before his voice did. "Bob, listen. No one listens to Nettleridge College phone lines, right?"

"Right."

"Well, I'm not Nettleridge."

He hung up.

Three hours later I sat in a plane headed for a layover in Cleveland and a connection with a flight to Sarasota. There, in the air, I remembered I had been thinking of taking the train to Iowa the next day. Iowa. Home of a *rara avis*—a *rara rana* would be closer to the truth, and *rara acris* would be closest of all—Blanchard's cricket frog, extinct or nearly so now over most of its range and still common in only a few areas of Iowa-Nebraska. I had made some calls to a herpetological friend in Cedar Rapids, a member of my amphibian-watchdog team. I'd even suggested a time and a meeting place. And had forgotten to cancel plans after Simon Kunz called. It would have sounded strange, I know: "Listen, Ed, one of the leading aerospace industrialists just called and I can't go on the frogging trip."

A businessman sat beside me on the flight. At the moment he stared at his lap, at his cellular.

"Flight attendants won't let me use it," he said, noticing my gaze. He had porcine cheeks despite a relatively slim build, and large eyes that looked both apologetic and spoiled. "But it's damn pretty, isn't it?"

The phone sat on with its back-side up, a trio of miniature screens there showing what I presumed to be videos. One screen showed what looked to be movie material. The other two spoke to me more loudly of the businessman's state of mind: a Saturday morning cartoon, and a pornflick with writhing, sweat-slicked bodies. A human nature show, I supposed.

I nodded. "Real pretty."

"Too bad we're born with only two eyes, eh?" He bulged his at me.

"Scientists are working on it," I said, wondering if they were.

"I owe you a beer," Simon Kunz said.

"Christ, you bring me here in the middle of the night to buy me a beer?"

He laughed.

An attractive, matronly woman had run me from the airport to the Kunz complex, and led the way to the office of the man himself. She looked like an older version of that resident assistant of ours back in that Beloit dorm.

Kunz looked pretty much like Kunz did the last time I saw him, down to the faint lines of worry. I had heard about his abrupt upturn of fortune when the States and the new provisional Moon governing body had an-

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nounced the revival of Mars expeditions junked nearly a decade before. Global Spacenet followed suit days later.

So I noticed and wondered at those lines of worry.

The office looked far more spare than I had expected. Even the window took in a relatively modest view of a courtyard and garden of mildly exotic plants. The furnishings had a lived-in feel. I suspected they had seen these four walls for all of the past ten years, a tight-belted time for the world that revolved around Simon Kunz.

He pulled a pair of English ales from a cooler with labels I had never seen before. I wondered that he had found time for pub-crawls in his down-and-out phase.

"Actually, you'll probably think it's an awfully small thing, what I bring you here for," he said.

The statement first made me angry, then made me laugh. "Simon! Our ideas of what's small don't exactly jibe, I don't think."

He nodded affably. "Right enough, Bob. And this I'm pretty sure is *my* idea of small. It'll seem pretty big for you, unless things have changed as radically for you in the past few weeks as they have for me. No? But anyway I couldn't tell you about it over the phone. If this leaks I'm cooked. You got that? Cooked. Let me give you this first."

He handed me an envelope, unsealed, which my fingers opened before caution could stop me. The writing on the check inside certainly stopped me breathing.

"What for?" I said.

"Hey, don't take it wrong! I'm not paying for silence! Believe me!" Then he laughed and took a sip of ale. "I'm paying for your research. You need money? You have it. Right there. It's made out to your obscure little frog-watch organization so you don't have to declare it as a gift or as income. Non-profit, right? Did I get the name right?"

I nodded.

"Good," he said. "So, let me ask you. Have you made a decision about—you remember what we talked about? About your frog skins? You weren't sure if you were going to do it or not? What are you doing, now?"

I told him about the cricket frogs. About Iowa. About possibly trying a re-insertion of the species in Wisconsin and Michigan.

He nodded. "So you think that's the one? The cricket frog?"

I pursed my lips. I *hadn't* made a decision to genetically alter them or any other frogs. What a decision to make, after all! How could I do it lightly?

Yet I had to admit the idea was growing on me. Deciding to go to Iowa, to fetch eggs if we could find them, was pushing me even farther in that direction.

I nodded hesitantly.

"Good." He grinned widely at that. The widest I had seen him grin. "Listen, Bob, we're going to work together."

"Hold on. You haven't told me what all the secrecy's about."

"The reason for all the secrecy's a secret."

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"Yeah, but come on. You're dragging me here in the middle of the night, and we've got beers in our hands. I don't know about you, but having a beer in my hand—and the fact that *you* put it in my hand—means you're about to lay a story on me. So lay it on. Thick, if you have to."

He shook his head. "It's amazing you got anywhere in science, you old barfly. But I'll tell you. I'll tell you exactly what I wouldn't want winded about, because someone in the news biz might get ahold of it, and might think it really *is* what's going on. You get me?"

I nodded hesitantly. "I think so."

"Good," he said. "Just imagine this. I'm telling you a story, see? Imagine someone sinks a lot of money into getting to Mars. A lot. To the point that if the nations of our two worlds, Earth and Moon, should ever get together and decide to finally make that push for putting people on Mars, maybe even putting people there in great numbers, then that person would stand to earn a lot—a *lot* of dough. I know it's hard to imagine someone like that, but do it for the sake of argument." He arched an eyebrow at me. "And now imagine this. Imagine the space biz undergoes a depression. The nations pull back from ideas about Mars. This someone we're talking about—let's call him Mr. Kudzu—he uses some of his resources and keeps pushing for Mars. Only he does it in secret. Say he thinks of a way of attracting public interest in that planet, and he does the development work. Say he pulls it off, and it's a phenomenal stunt. I don't know what the stunt would be—but, oh, say he invests in a bioengineering project, and creates a plant that can live on Mars, that can reproduce in those conditions and spread like mad, and that slowly begins to alter the atmosphere and hence climate of the Red Planet once it's there."

"That's an awful lot of what-ifs," I said.

"I suppose so," he said. "But they're good ones."

I laughed at his devil-take-it gesture. "Do I get this story right? This Mr. Kudzu *sends* these things to Mars? Without consulting anyone else? And these things then reproduce and somehow attract public interest?"

"Hypothetically, yes," Simon said, leaning back and smiling. "Think how cheap it would be—from my point of view, Bob, not yours. All you would need to do, once you have the proper organisms, would be to send the ship. You wouldn't need to get it back. It could all be automatic. A robot planter—or hundreds of them, more efficiently—would emerge from the landing craft and go about the process of cultivating what are in essence weeds on Mars."

"Weeds on Mars, eh?"

"Yes. Weeds. The weeds, the robots, the landing craft, they all stay there. That's a big savings right there. But you remember our conversation about changing things? Ecostrophism? I think I told you back then: you have to decide. Either you're going to keep hands off, or not. If you decide to get your hands messy, then it's an open question as to how far you go."

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"I see," I said. I *did* begin to see and what I was seeing bothered me not a little. "What sort of plant might it be?"

"Like I said, a bioengineered one. But with some Earthly beginnings. Say, a quick-growing vine that might be common in the South. And some resistant root system capable of dealing with permafrost and other extreme conditions, say from some tundra plant. Plus other genes from hither and yon. I'm just putting this out as theoretical, you know."

"Theoretical," I repeated, nodding, seeing the Green Spot in my mind's eye. I waved the check in my hand. "Theoretically speaking, what part does this huge check have to do with this story which of course is not true and which you don't want the news to get?"

Simon put his hands together and looked at the marvel of bioengineering contained in his brown ale bottle. "I suppose that piece of paper might fit in the story. For instance, imagine that Mr. Kudzu wants a bioengineered toad —one with *high* tolerance for UV and maybe low-O_2 conditions—"

"A *toad?* Why?"

"Well, maybe Mr. Kudzu released not only a species of plant of Mars, but insects, too. More than one kind. A pollinator, a predator, a pest. The first two kicked the bucket. I mean, theoretically they might kick the bucket, and Mr. Kudzu might need a back-up predator. The pollinators don't matter, since the kudzu—I mean the Martian plant, whatever it might be—spreads pretty rapidly as it is by means of rhizomes and creepers. It's all-purpose, when it comes to propagation. To come up with new predators, however, Mr. Kudzu might possibly already have people working on spiders and a kind of parasitic wasp, but he might think it worthwhile to have—"

"Martian *toads?*" I said. My mind staggered—easy enough to do, since it was already staggering even though I had hardly touched the ale. I *mean:* A kudzu grows on Mars!

"You got it," he said, raising his bottle in toast.

Later, after several more toasts, and several more of the means whereby we toasted, he looked at me soberly, or at least with the appearance of sobriety, and said, "Bob, you know it as well as I do. Some things are impossible to do alone. So you got to get help. And what do you do. You give them a kick in the ass. A big one. A wailing big kick in the ass! The whole damned world public if that's what it takes! A *wailing* big kick!"

The Green Spot. A bright spot in the history of our reaching out to other planets, is how it will be remembered.

And as a wailing good kick in the hinder!

Me, I'm glad my rear still smarts.

Whether Simon will be as glad, once the public finds out how it's been flamboozled, I don't know—

Whoosh! I can imagine the paddle now! A *red* spot!

But we'll be laughing in our dotage, Simon and I, surrounded by our vines and bugs and these modified black-skinned South American toads I have here in this shipping container, sucking in the CO_2, ready to go.

As I will be, one day.

One day, when that red light in the sky turns *all* green. ■

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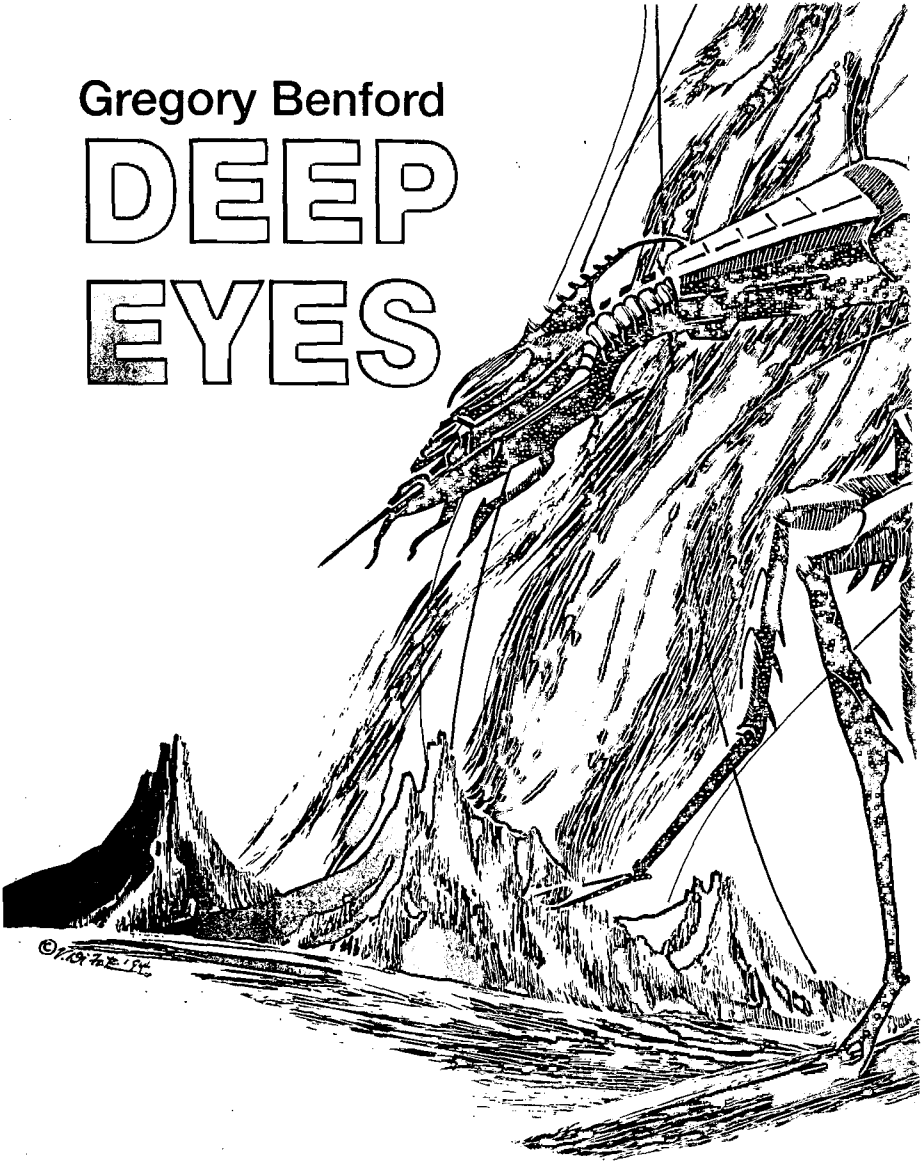
Gregory Benford

DEEP EYES



The relationships between generations can change dramatically as time goes on—especially when the generations are very different and time extends to the far future and beyond. . . .

Illustration by Vincent Di Fate

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1. A Mantis Blankness

He and Quath found the alien machine in the yawning darkness. Quath sent an emag warning, a crisp orange pinprick popping through Toby's sensorium—then silence.

Toby waited. Quath moved silently to his right, enclosed in a sullen black so deep he could not see his hand without using his sensorium. The Mantis was up ahead somewhere. Senses he could not even name told him that other creatures moved here, too. They had little or no emag but they were tracking, following chemical trails left by others—scents seeping from deep glands, puffs of clinging odor released by accident or design. Everything here had mastered these chemical channels.

Toby's natural senses were deaf to them. Humans drank in sounds and sights, the primate strong suits. Here the small noises of burrowing and scampering told him that there were other theaters, other plays in progress, and he would never be in the private audience. Yet he and even Quath had been of that theater, graduated from it perhaps to this curious shadow world of electromagnetic scents and jolting voltage deaths.

A trickle of inquiry eased into his sensorium. There: Quath. Together they moved up through snatchy brush. They took the time to slip by the snags. Even a small tear could alert the Mantis and there might be a trap, too.

Quath shivered with anticipation. Rivulets of silvery magnetic excitements came to Toby, scattershot and short-range, involuntary effusions.

The mutter of chemical life stopped. Silence. Toby could see nothing, through eye or sensorium inboards. Quath came closer, a presence he felt by a wedge of blocked air, to his left now. Then he caught it. The Mantis was a slab of nothing to the right. He could not have felt it unless he was standing absolutely still and ready.

His sense of it did not come from rich spatterings of his detection gear, sprinkled down through his nerves and bones. Those were silent. The Mantis was still well enough to make itself a blankness, an absence.

It moved by them at indeterminate range but Toby could somehow smell it. The old senses brought a stink, sour with a cool rot. He did not dare to move but the smell floating on a slight chill wind told him enough. The Mantis was moving fast and the empty patch shrank. Grey rimmed the spot now. It looked ordinary but he knew it was a Mantis blankness. Out of it could come in any split instant a forking spike. Death or injury, on emag wings.

Then it was just a point. Still moving. Toby whispered on short-range comm to Quath, —Got its signatures?—

<Several. It is wounded, as your father said.>

—How bad?—

<The eating entities invade it. They chew at its subselves.>

—Think it can shed them?—

<It has great resources. Perhaps it can cure itself.>

—Then we've got to get it.—

<Someone must. To be truly sure

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it does not survive.>

They retreated then. Carefully, at first, they went back through the still total blackness and creatures stirred in their path. The Mantis was not even a dot now and Toby let himself go, not minding the rips as they got through a wall of thorny brush. His suit would self-heal in a while but the time lost now could not be made up except by head slogging. He and Quath had tracked and searched for a long time now, and beneath the buzz of energy in his legs he felt the seep of weariness.

The wind was picking up as the ground also moved under them. Here the esty shifted and deployed with a sullen energy and they had to be careful of their footing. The terrain itself was of alien making, a labyrinth made of space-time by forces ancient and unknown, and the Mantis seemed to know it better than humans did.

They picked up the supplies they had dropped earlier. Toby had shed his weapon, a sharp-darter long and elegant with power simmering in the butt.

Quath said, <If you had carried that, it would have seen us.>

—You're sure?—

<Nothing is sure now. Though it is crippled, it knows a thousand ancient tricks.>

—We know a few, too.—

<It lives in the electromagnetic world. We only visit there.>

—You're half mech yourself, fella.—

<In brute fraction, true. But my mind is Natural, with all the happenstances which evolution brings. The Mantis has made itself and revised itself time and time over.>

—Seems to me that just makes it a patch job.—

<I believe you are manifesting a bias born of insecurity.>

—Ha! Insecurity? When the Mantis and its kind have killed so many of us?—

<Perhaps I chose too weak a word. I do not wish to anger you.>

—Family Bishop's lost over half its members to that Mantis.—

<I know, and do not wish to excite primate responses.>

—Huh?—

<You are known for your grudge bearing and love of territory.>

Toby had only a vague idea what Quath meant, but that was not unusual. She was a blend of an insect-like organic race—her "substrate," as she put it—and machine additions. In her bulk she carried the computing capacity to communicate with humans. The reverse path, people speaking to the Myriapodia in their digital staccato, had been a failure. Humans did not have the capacities or capacitances.

—We're known for being hard to kill, mostly.—

<That too.>

—A Bishop sights the Mantis, we go after it. Is that "grudge bearing"?—

<Never turn your face from the central fact of its alien nature. It is of the kingdom of machine. I, despite my modifications and encrustations of mechanical artifice, am of the kingdom of the flesh. As you are.>

—Uh, guess so. Right now this

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flesh needs some rest.—

2. Hard Pursuit

"You sure it didn't pick you up?" his father asked.

"Yeasay."

"Quath?" Killeen's eyes swiveled to study the huge head of the many-legger. Toby never knew why he bothered to do that. Habit, maybe. The alien's face was an array of sensors and Toby had never been able to read any expression there.

<It is the nature of electromagnetics that detection can never be ruled out.>

"Damn all," Killeen said, "I didn't ask for a lecture."

<I estimate that it did not know we were there.>

"Confidence level?"

<Approximately seventy.>

Killeen nodded. "Fair enough. Let's go."

"Now?" Toby had wanted to ease back a bit.

"No point in waiting."

Cermo muscled his way up the slope, puffing to the ledge they were all sitting on. "I get nothing from outlyin' pickups."

His broad face furrowed with concern but he said no more. The big man settled onto the ledge and looked out. Pale gray light seeped into distant timestone peaks. It was like a smothered dawn on a world that had curled up onto itself. Above them hung a distant landscape of tawny desert. Dried out riverbeds cut that land, several hundred klicks away but still visible through a cottony haze. Those river valleys looked ancient and Toby knew they could reach them with maybe a week of hard running, through esty slips and wrack-ranges. Maybe the Mantis would lead them that way. This lane was twisted and tortured, space-time turning upon itself in knots unimaginable until experienced.

"Let's vector for it, then," Killeen said and stood up.

Toby felt a surge of zest as they started out and it lasted until they picked up the Mantis trail. As first he thought he was stronger than Killeen and Cermo and even got impatient with their slow tracking, sweeping the area for signifiers. Killeen halted for a rest every hour, old Bishop Family discipline, but at the very start of a pursuit it irked Toby.

—I could damn sure get ahead faster than this— he sent to Quath on private comm.

<So could I. That eludes the point.>

Quath ran on internals of huge energy. She could outpace them all. —Maybe you should go on ahead.—

<I know my limits.>

—What are they?— Toby was genuinely interested. Myriapodia abilities dwarfed anything human.

<I am not a primate.>

—Um. That all?—

<For the moment, for this purpose, that is enough.>

Beyond that Quath would say no more. Toby puzzled on it for a while but by then he started to tire and Killeen and Cermo were still moving at their same steady pace. They took the same short rests exactly every hour and picked up and went on. Quath

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herself was upping the pace too. Or so it seemed, though through his sweat-stung eyes the land was opening faster now to Toby and he plunged into it with a fresh energy born of the fatigue itself.

They came upon the first of the Mantis loci in a slope of shimmering timestone.

Cermo sighted the small shiny hexagon. "Mantis is fallin' apart," he said, kicking at it.

<No! Perhaps I can read.>

She did. <It contains splinters of the Mantis self.>

Killeen's weathered face tightened. "Why? What's it doing?"

<I suspect it is shedding unwanted portions. Subminds it does not need.>

Toby asked, "What's the sense in that?"

"To lighten up," Cermo said.

Toby tossed it in his palm. "No mass to this thing."

"Probably just junked a whole seg and this is a frag." Cermo said. He had tracked mechs of all descriptions and held them in a lofty contempt despite the fact that mechs had brought down many of his friends.

"Good sign," Killeen said flatly and they went on.

The ground began to move under them. The worst of it was in the gut-deep confusion, nausea, and sickening lurches. Toby's eyes did not tell him true about what his feet and body felt. He remembered Quath saying once about the timestone, *The defining feature is the lack of definition.*—which he had thought to be a joke then.

Not now. Rock parted and pearly vapor churned from the vent. Sheets of esty purled off in gossamer sheets, dissolving as they rose. Spray rose, enclosing him in a halo of himself, somehow caught and momentarily reflected in the event-haze, as if he were both there and also flickering into the surroundings and joining them. The other self peeled away and circled to the tops of the cliffs and became a wreath in the shearing wind, soon frayed into refractive vapor.

"Gets hard here," was all Killeen said. They went into broken country ahead.

Then he knew he should have stayed behind once he and Quath had sighted the Mantis. He was a Bishop full grown now but for this pursuit experience was crucial and he had little. The Mantis and Killeen had fought each other ever since he could remember. Toby wanted to be here but he knew he was a drag on the others, though of course they would not speak of it.

Cermo said it with his eyes, firm and black. There was nothing to be done, the pursuit was on. This terrain was too dangerous for Toby to backtrack by himself; the Mantis was not the only high level mech here. They had watched from a distance as navvys and grubbers mined and foraged for mech debris.

So he settled in. He went hard and long and said nothing. Around their passage seethed strange vegetations, curled rock and clotted air, the esty's energy expressed in frothy plenty. To Toby it seemed some moronic God

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kept reshaping the land beyond any probable use. The green profusion here seemed demented, underserved. He realized only dimly that his irritation came out of his fatigue. For that there was nothing to be done and in his father's face he saw that. He kept falling behind their long, loping stride and so was glad when they stopped suddenly. To stay on his feet as they studied something on the ground he leaned against a rock, out of fear that he was already stumble-around tired.

It was a spool of something translucent yet mica-bright. <More discarded self,> Quath said. <Note also the locomos stripped away and left.>

In a hollow were dusty locomotion parts, a whole tractor assembly, footpads—all junked. Toby looked them over and saw they were modular.

<Left behind.> Quath rattled her flanks. <Defective. Or too much mass to propel.>

Cermo and Killeen inspected the ground. They had done that all along the trail, talking to each other about the tract. Toby looked at the round depressions and flattened angular prints and saw the broken twigs where the thing had passed. The twig stems were not dry yet and Cermo fingered them around there. Crushed wild grass lay squashed but not browned as it would be soon.

"It's doin' pretty well for broken country," Cermo said.

Killeen frowned. "Going to be hard."

Toby said, "If I could make it out, maybe its systems are so far down—"

"You said you didn't see it," Cermo said. "Just felt it."

"Yeasay."

Cermo shook his head slowly as he looked down at the matted grass. "If we run up on it, won't be feelin' our way."

Of course he was right. The Mantis was invisible to human sensoria. It could deflect attention from itself, disperse telltales, turn a thousand techtricks. Toby scuffed at a stone and said nothing.

<I believed its abilities are diminished,> Quath said.

"Enough so it can't ambush us?" Killeen eyed Quath's shifting bulk skeptically.

<Perhaps. It sheds mass, then the locomos that propelled that mass, trying to move quickly.>

"Or wants us to think so," Killeen shot back. He smiled to take the sting out of it. Toby wondered if Quath would understand the quick flash of yellow teeth in the rugged, walnut face.

3. Confusion Squall

Toby got dazed as the pace quickened with each passing hour. His wandering, miasmic mind was his true enemy now. He kept loping, inevitably behind the others, trying to go through the fog that deadened him.

They tracked the Mantis by its footpad scrapes across rocky ground. Cermo and Killeen took turns sweeping to both sides in case it was backtracking or leaving a false trail. They kept looking back to be sure Toby was still in sight. The humiliation of it was that they had done that years ago when Toby had been a boy and

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now he was not.

Men and women kept growing throughout their lives, so adults could outpace their children until the fragilities of old age finally caught them. There had been a time, Toby knew, when a boy reached manhood and was as strong as anyone. The competition with the mechs, who could always augment themselves further, had ended that. Humans had changed their own biology and chemistry to compete and in that way had become strangers to even their own past.

The timestone ebbed. Gauzy glows seeped up through the rough landscape. Days and nights were not evenly spaced here because the illumination came from light trapped in the space-time curvature itself. Refraction and time lags gave the radiance a hollow quality as though it had been strained through some filter and leached of its sharpness. They stopped and made camp and Toby fell asleep leaning against a boulder. He discovered this when he hit the ground and the others laughed, though of course not Quath. He made himself lay out his pad and once on it fell asleep again, and only woke when his father pulled off his boots to check his feet for blisters.

"You're doing yeasay," Killeen said softly in the dim dark. Toby's nose caught the heady scent of cold but cooked vegetables and he found a plate of them next to his head. He ate them without speaking and his father brought a spicy tea hot from the fire. It was not a flame of course but a carbo-burner, so no mech could track them from the smoke or light.

"You're holding up. Feet fine."

"Just need some sleep," Toby said.

"You and Quath were up finding it while we were sleeping. No reason you shouldn't be a little behind."

"I'll do the sweep searching tomorrow."

"Don't take on too much. Have some more of those beans."

"Not all that hungry."

He was asleep before his father had turned off the burner and he heard nothing as the darkness waxed on. He thought of the Mantis or maybe he just dreamed that he did.

The next day he remembered the sleeping fondly before many hours of loping were done. It was bad by then. He had started fresh but it faded and he sweated more than he ever had. Quath spoke to him with some concern but Toby talked little. He carried as big a pack as the others but they also had the burner and some extra food so he was behind in that as well.

Cermo did not smile or waste energy on talk, and Toby remembered again the intensity of the man on the plains of his boyhood. That had been when humanity began to take on the mechs here on even terms and the fighting had been bitter.

Cermo pointed to each sign of the Mantis and interpreted it with assurance. Cermo was pointing to a fresh print when the confusion squall hit home.

Purple bees. It felt as if they were biting him as they swarmed inboard. Toby got down fast but the fan beam caught him and he could not see any more. He rolled downhill and fetched

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up against a rock. That jabbed him in the side and he rolled around it and farther downhill. That was the surest way to get away from the swarm of emag turmoil. Above him hummed a tangle of magnetic fields and orange plasma discharges. Forking energies. His inboards covering up made sharp clangs in his sensorium.

He slammed into a gnarled tree and could then see again. He lay there looking up at the others. They shared the stupefaction. Two heartbeats, three. The squall passed without any follow-on bolts.

The Mantis used these to soften targets. Not attacking made no sense. He walked back up the hill and Quath greeted him with, <It is leaving them as traps for us.>

"Good, 'cause otherwise we'd be dead."

A malicious grin split Cermo's face. "Means it's desperate."

"Wounded," Killeen said and picked up his pack where he had dropped it at the first sign of trouble.

They moved faster then and it got worse for Toby. The confusion squall had robbed him of his zest and the dry air sucked sweat from him.

The Mantis was an advanced mech and thus a timeless enemy. The earliest intelligent life in the galaxy, who had produced the early mechs, knew the dangers inherent in the conflict between the two forms.

The mechs had slowly decided that the Naturals were no longer semi-divine forefathers. They had become competitors, using the same raw resources of energy and mass. Such conflicts were inevitable. In the long run, no life form owed another indefinite homage.

Against this certainty, the earliest organic races wanted a trump card. The First Command.

Deep in the inner design codes of those early machines, they embedded a First Command which could not, even in principle, be detected. Activated, those brought great pleasure . . . then, a kind of interior death by ecstasy.

If another trigger code was activated from outside—the Second Command—the mech felt the impulse to convey its sublime joy to others. Then pleasure became a plague.

Humanity had done this to the mechs in the esty, once they saw that the conflict between humans and machines would be without end. Except for the Trigger Codes.

Naturals and mechanicals had collided in the Esty, a labyrinth of lanes built of folded space-time. No one knew who had made it. It had been found orbiting the giant black hole at the center of the galaxy, and so had become a stage.

Toby could not truly conceive of the expanse of time and therefore of injury and anguish, of remorse and rage and sullen gray sadness, which had washed over the ruby stars themselves. It had cloaked the galaxy in a wracking conflict which could never be fully over, he knew. From this primordial pain there lumbered forward into his own time a heritage of melancholy unceasing conflict which had shaped all his life and had made the Family Bishop culture he so revered and would die to defend.

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In Killeen and Cermo and all the Bishops there smoldered a fire that would never go out until the Mantis died of the Trigger Commands. All Naturals, even half-mechanical forms like Quath, shared that hatred. The Mantis was the last of its kind and the Bishops had sought it for years now. Toby had been lucky to find it, after reports in the area seemed to lead nowhere.

"It's sick, that's certain," Killeen called as they moved.

"We're getting closer," Cermo answered.

<It is trying to cure itself,> Quath said.

"How you know?" Cermo asked, head swiveling in surprise.

<The illness might be arrested if portions of the Mantis, its subminds, can be shed. Once infected, they are ejected.>

"That spool?" Troy asked. "And the hexagon?"

"It hoped we'd miss them," Killeen said, his mouth twisted with surprise. "Dropped that other gear to make us think it was just shedding mass. Yea-say, Quath."

<The pleasure plague can operate in its higher minds, but on unconscious portions. It then spreads to subminds and becomes overt. The bliss disguises the damage for a time, despite its higher minds.>

Cermo asked, "Why not shed all the subminds?"

Killeen answered, "It'd have no defenses against us."

<It is being hunted within and without.>

Toby croaked, "Hope it's getting tired," but what had intended to be a lighthearted remark came out desperate.

His father dropped back and studied his face. "Just last out a few more hours," was all he said.

"I'll take fore point," Toby said suddenly.

Killeen looked at Cermo, who nodded. "Keep a sharp," Killeen said. He went back to sweeping the right, tracking.

The navvy hit them as they came down a narrow draw. It was a fine place for an ambush and if the Mantis had done the job itself several of them would have died or at least gotten scrambled pretty badly. The navvy was a lesser mech which apparently the Mantis had assembled in flight. It looked like that.

Toby saw it just before it fired at them. Its big disks were extruded and the emag burst fried Toby's left side. His servos froze and his legs locked, *chunk* and *chunk* and then no feeling. He went down hard.

The beam swept across Cermo too but he had been faster and blew a hole in the navvy. That saved them from a real frying.

Killeen was in the clear and took his time. He got the navvy square so that the emag reservoirs in it spilled out in one long shriek. Then it was dead.

They rested while Toby got his servos back up and running. Nobody said much but his father helped him with the crisped sockets and remarked casually, "Those navvys aren't as slow as people think."

Toby knew what that meant and in

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recollection knew that the navvy had been pretty slow. He had been loping through his own personal fog and had missed the profile when it popped up on his sensorium. Ignoring signs while on point was stupid.

"Sorry," was all he could say.

Toby kicked the navvy in exasperation and then bent over the cowling. He popped some seals and rummaged, and brought out two smooth ceramic things shaped like lopsided eggs.

"Mag traps," Cermo said.

"Fine." Killeen handled one carefully. It had the usual mech slots and looked all right to Toby. "Can we use them?"

"Lemme try," Killeen said.

"Sorry," Toby said again.

Killeen slapped one of the eggs into a hip servo. It clicked on. "Good find." That was Killeen's way of answering. "Let's eat."

4. The Suredead

His gear used the position traps that were new and light and carried a lot of energy in a small magnetic pocket. The clouds of positions gyred in their magnetic pit and when his inboards or servos needed power positrons would snake out of their snare, find electrons, and die. Somehow that made potentials stream through him though Toby never thought of how it worked. The navvy's mag traps they discharged into their own, harvesting most of the store. Energy stripped from mechs always had a special jolt to it.

Killeen clapped him on the back. "Just shows how desperate the Mantis is," Killeen snorted with derision. "Threw that navvy together quick and sloppy. Put no defense in the mag traps."

Toby felt better until he woke that night. The timestone was smoldering a dull ruby red half-light and they had all rolled their pads out to take advantage of the momentary night. Toby had been bone tired and grateful for it, a break not given as a favor by his father but simply by the weather.

But he woke up with an itchy nervousness and could not sleep, thinking it had something to do with the positron power. He got up to pee though it was not pressing, and that was when he saw it.

The lattice work did not move against the far ruddy hills, but it was not a building. It cast a shadow somehow in his sensorium that was not a blankness now. He looked for the webs of loci and motivators and subminds. They were faintly luminous and traced out the array of rods and struts. It moved then and he felt it as a positive thing finally. Not a vacancy but a presence.

He knew by legend the impossible way it moved. As he stood absolutely still and watched, the matrix shambled away from him. No hurrying, no sign it knew he was there. It was two klicks away, easy. In range, but he did not think of that. He followed to keep in view the shifting phosphorescent mainmind exposed in the tilting work of rods and the great disks swiveling.

It came to him then without a single flicker of sensorium warning. The burst was in him, before his inboards could counter. He staggered and fell.

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Hit hard, arms loose. The pulse skated through him and burned hot and was gone.

He lay without moving, Bishop tactics. Numbly through his sensorium he watched it go. Angular energies, vectoring into a dwindling shape. Then nothing.

He let his inboards run diagnostics and they came up with trivial overloads, easily corrected with a reset. He got up carefully. Creaky and legs shaking at the knees, but all right.

He could not explain what had happened. He knew he had to think about it but not right now. There was too much in him. A pressure seethed in his systems. Fear and a hollow longing, too. Some quality of it reminded him of the way women drew him out, but it was not that either. On the way back to his pad he decided not to wake the others.

Quath stirred elecromagnetically as he passed. <?> she sent and he answered with—.^.—which told her submind that it was just him. He envied the way she could delegate to her partial minds and fall instantly asleep if she wanted. It was a little surprising that such an intelligence needed the down time to process memories and arrange itself, which humans did by letting the subconscious levels work during sleep.

It was the dreams that told him. He saw the long procession of Bishops in their Citadel, then on the plains, in battle, and at peace. Many of the momentary shimmers of saved experience were of their last moments. That must mean that these were salvaged slivers from the lives of doomed Bishops. Eyes wide with surprise, or slitted by pain. Mouths gasping or else hardened against what they saw coming. But there was more to it than such externals. He *felt* the moments, lived through them in a way impossible to get from a mere image.

These were the records of the suredead. Bishop minds, ransacked by mechs—by the Mantis—in age-old conflicts. Like volumes to be kept on a shelf and taken down and browsed. Or read intently if you cared.

The Mantis had sent these shards of the suredead into him. Discarding them? Radiating away data as it executed its own subminds?

He rolled sweaty in his sleep and woke sandy-eyed and ragged. At breakfast Killeen said, "I got some diagnostics on my morning screen. Said there was mech near us last night."

"Me too," Cermo said.

Toby said nothing and did not know why. The Mantis was probably going to die anyway. The two men looked at him and still he said nothing.

"I can pick up right now some pretty weak echoes that way—" Cermo gave a thumb-jut uphill— "but not moving."

Toby could see nothing in his sensorium. When they started off he took rear point. They lost the Mantis trail in a place where overlapping mech signatures reeked in Toby's sensorium, coded as stinks. He caught rotting leaves, a sharp pungency, something damp and musty. "Smells funny," was all Cermo said.

They followed the smells, all really just electronic prompts but no less

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exciting for the fact of their knowing it. They found the cause in a rugged narrow gulch.

The mechs had died in convulsions. Disease programs had gotten into them and they had ended in an agony of pleasure, capacitors flashing over, mag traps sparking and searing their gray mat finish. That was what made the Trigger Codes so good. They brought intense ecstasy and the desire to share that with others, and so the mechs sent it on electromagnetic wings to each other, all in a delighted delirium. Toby knew it was supposed to be a pleasant way to die but the convulsed limbs and ripped matte-carbon skins were ugly, terrible.

"Mantis was through here," Cermo said.

"I pick it up," Killeen said and then Toby did too, a faint tangy odor that wound between the mech bodies. These were far lower order mechs than the Mantis of course and they crammed the little gorge. The Mantis had passed by the fallen and gone on.

"Paying its respects, maybe," Toby said. The men laughed although he had not meant it to be funny.

Toby touched one of the wrecked carcasses. "You suppose mechs have, well, families?"

Cermo shook his head vigorously. Killeen said. "Not so's you'd notice."

Quath had been nearly silent since the navvy attack and now she said, <They appear to have intricate relationships, but not genetically based.>

"If not family," Killeen said, "what?"

<Links of their minds. Or shared models of the world.>

Killen frowned. "Models?"

<Frames for comprehending experience.>

"Seems to me you either ken things or you don't." Killeen grinned at Cermo as if this were a private joke. Toby didn't get it.

<They seem to order themselves in social strata, based on capabilities. Within those classes they form close working associations.>

"Not families, not at all," Killeen said bitterly.

5. *Stalking*

"Why doesn't it fly?" Killeen asked during one of their short breaks.

Toby had been wondering, too. The Mantis could jet across lanes. Men didn't have flying gear. They couldn't generate the thrust to deal with gravitational stresses, not and be able to walk, too. "Maybe it can't any more?"

Cermo swallowed some water and spat it out again, an old ritual to get the dust taste out of his mouth. Then he cocked an eye at the distant emerald roof, the folded terraces of land far overhead. "Could be it threw away its propulsions first thing. We just didn't run across them."

Quath murmured, <Perhaps it does not wish to fly. Being foot bound and pursued is a different experience.>

The men looked at each other and shrugged. Toby wondered what Quath could mean but she ambled away then, combing the area. He did not get a chance to think further because Cermo was looking up at the

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foggy Esty again and frowning and then pointing. "Matterfall," he said quietly.

Masses of green and brown ripped away from the landscape above. Silently they shot up in a geyser. Lumps tumbled and smacked into each other. "Coming fast," Killeen said nervously.

There was nothing to do. Sometimes the esty fissured. Along its surface gravity would abruptly vanish as stretched lines of space-time snapped back, like rubber bands releasing energy. Matter would find itself suddenly released, free.

"No pretty li'l arch this time," Cermo said.

Sometimes the trajectory of a matterfall made an arc and the mass slammed back down nearby. Once the freed debris got high enough, though, it could just as soon spray all the way across the vast space between Lane walls. This time it had more than enough energy. It seemed to speed up and still there was no sound.

"Coming close." Toby stood with legs tight and ready to run. But which way?

The clotted stream of mass shot toward them. It swelled and Toby saw trees and rocks clearly. The leading edge was a little to his left, he saw, and then very quickly the whole sheared mass came down toward them.

Close, but not right smack on. It slammed into the esty unslope. The shock wave bowled them over. Thunder followed it. They doubled up against a spattering rain of pebbles and silt. One hit Toby in the shoulder and hurt but broke nothing.

It was over in a few minutes. They brushed themselves off and looked up at the damage. Some hills had fresh cover and boulders were still tumbling down and crashing into ravines.

"Be bad footing over that way for a while," Cermo said.

"Wonder if the Mantis will go that way on purpose," Killeen said.

Cermo frowned. "I 'spect so."

That was what happened. Their tracking told them so within an hour.

Trouble came immediately. The Mantis trail led into the shifty new ground. They labored upgrav toward majestic, brooding slopes. The rock here was bare, thickly folded esty. The matterfall had liberated fresh energies. Events curled out of it, sliver-thin instants from the past which splintered off and then evaporated. Going uphill was like climbing a full, heaving wave that crested and was always about to break its sharp peak into roaring foam. Bowls formed in the slant timestone. In them were lakes not of water but of some chipped gravel that flowed. It was easy to mistake for a water lake because the granules of shattered esty were a pale turquoise, as if blue with chill. Toby dipped his hand in and jerked it back scalded. He danced around, flapping his hand and feeling stupid and angry with himself.

He was not paying attention so was surprised when the ground trembled and opened. Toby fell into a cleft with edges sharp as torn tin. He scrambled and got out just as quick.

Neither Cermo or Killeen noticed

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any of this because they had just heard the Mantis ahead. Quath had vectored on it.

Toby ran to catch up to them. Abruptly the Mantis disappeared from his sensorium. It left not even the Mantis blankness.

"Get it on visual!" his father called so he knew that the others had lost their sensoria traces, too.

Toby plunged upslope. He had to use all his power to manage it and he could not see the others. Thick cover festooned the ground here and shook and rattled as timestone gave way downslope. He heard crashing and explosions below. If a piece of the esty slipped into instability it carried off everything. The shaking got worse and he fell.

—Cermo!— he sent on hushed comm. Nothing came back.—.^.—he sent to Quath, but again nothing.

Still, he could smell the Mantis somehow. It was not a sensorium cue but a flavor cool and metallic on the dry air.

He understood this last desperate move. The Mantis had led them into unstable territory to throw them off. He wanted to cling to the trembling ground but the smell was strong. Fronds rattled above him as he picked his way upslope and into a divide. He knew it was up ahead but did not know how he knew.

A brilliant white flash went by him and the second smacked into him. The pain snapped down his spine. He hit and rolled. Only then did he register the quick rapping bursts that had come before he was hit and recognized his father's emag rifle. Cermo's booming reports came right after.

His systems convulsed. His legs had curled up with the pain and he could not brace himself against the timestone as it cracked beneath him. Sharp shards peeled off and shattered and cut his face.

His world clouded up with the pain. Cermo's punching booms and his father's *rap-rap-rap* came cotton-soft in the hollow air. The two men were shooting steadily now. Toby still could not see their target though the metallic smell was stronger.

Quath sent her characteristic *whoom whoom* echoing through his sensorium. She was using her weapon that scrambled up interlinks and could dissolve a mechmind if it went in just right. They shouted now in his comm but seemed far away. They had not gotten visual of the Mantis either and their calls got fainter as they moved away.

He got up painfully. No broken bones. A wad of cloth from his pouch stopped the bleeding in his scalp and cheek. More hollow firing. Then he saw it. The blankness rippled in his sensorium.

A shot caromed off him. It hurt but did not get into his inboards. Something else did before he could react.

—the two lines of running figures met on a dry plain. Here men laughed wildly as they grinned through filmed helmets, slapping each other in salute. The two Families had not met for years and now to come upon each other, Rooks and Bishops colliding. Only taste and touch mattered, the press of warm and pungent flesh, rank and salty.

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Hugging and patting. Sobs as old friends saw each others' lined, worn faces. A babble river of talk, hoarse cries, guffaws—

It came in so fast he got only a stinging sensation. A nose-wrinkling itch, a furious sneeze. So fast he was all reaction, no thought. Then he saw the matrix of rods moving in the clattering fronds nearby. No more than a hundred meters.

Slow, underwater slow. He shot at it and missed. Mantis fields deflected nearly anything except a direct pulse. A shot had to be shaped just the right way to defeat its layered minds of defense.

He ran down a gully that snapped and cracked beneath him. The esty energies played in blue-white arcs where his boots struck. He knew he was not seeing quite right from the pain.

More booming reports and a crashing and it was all going steadily away from him in the fog-thick clotted air.

Cermo screamed. His shriek sliced the comm.

The Mantis reek came stronger.

Toby scrambled out of the gully. Timestone frayed upward here like spores blowing. It fractured, split. Big zigzag lines ran back into sour-smelling bushes.

He ran toward the thrashing sounds. Uphill. Tripped and got up and went on.

—in the celebration came a hard spang *and then streaming talk turned to shouts. Screams. Bodies falling, others trying to catch them. Shocked, bleached faces. The stinging notes were emag shots and the Mantis was a speck on a far rise aiming into the reunited humans, being very careful to focus on a single fleeing form at a time. It brought down more and drew the essence out of the primates as their little lights flickered and began to go out. Pain, remembrance, joy, gray defeat, soft dreams—all siphoned into it. All was saved.—*

He staggered with the hard-blown intensity of the burst. Where was it?

The bushes were high here and scraggly trees hung above them. On his comm he got a pip from his father and Cermo beyond. On the topo display Cermo was on the hillside and highlighted. Killeen was moving away from Cermo and headed farther uphill.

Toby angled up a ravine. He had to cut his way through some of the wiry bush and came upon his father suddenly.

Killeen was white-faced. "Got Cermo pretty bad."

"You tracking it?"

"Hit it pretty solid and it's trailing smell."

The stink was metallic and oily now. Toby knew the true data his systems compiled were not smells at all but the scent blended with the memories it had projected into him and together they reverberated in him.

There were plenty of other signs. Scattered loci had spattered the bushes with burnt orange and crimson. Mantis castoffs. A seared cowling lay cocked against a tree. "Careful of it," Killeen said. They went by cautiously but the piece was dead.

"Dad, back there it sent memories

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to me."

"Tryin' to confuse you."

"I don't think so."

"You look to be woozy."

"I'm OK."

"Been hit?"

Toby nodded and gasped for air.

"Maybe you should stay back with Cermo."

"I can keep up."

"Not what I meant."

"He's not good."

"I'll head back for him in a little while."

Toby saw Quath on topo a fair distance off. She was blocking the Mantis's retreat. "It's close by. Smell that?"

Killeen said, "We got the bastard now."

"It wasn't trying to get me solid. It wasn't—"

"Its body's shot," Killeen whispered.

It was. A heavy odor of something like suffering layered the air as they came into a stand of gnarled trees and thick undergrowth. They trotted as quietly as they could although speed mattered more now.

The Mantis was leaning against some trees. Branches stuck through its open spaces. Coming up on it slowly, Toby thought the thing looked as though the trees had grown in the Mantis body itself and it was now a work both organic and mech.

He could see the back of it, jet black and soft gray and huge, lattices united with complex angularities. He followed his father along flanks that sighed and settled as though something was going out of the Mantis. Something was—fleeting wisps of data hummed and buzzed in their passage.

It was as big as a house and Toby saw now the way energies had held it together and would no more. More slabs of data emitted from it like blood running out and Killeen raised his emag and fired. The Mantis had antennae and disks in their own enclosed bays and one of these focused on them. That was its only reaction. There was no need to do it mechanical damage, to use explosives or bolts. The intricate information web that made up the Mantis was frying into nothing. Programs from the Trigger Codes fed with a crackling intensity that Toby could hear eating like flames through the whole gray sensorium of the Mantis. Three parabolic antennae swiveled to look at them. His father fired again and the whole thing shook like a house about to come down.

Toby backed away. "Plenty done now," he said.

"No."

The Mantis fell. Parts popped free and rolled and the intricate crystalline layers smashed. Some beautiful arc struts popped from their collars and the complexities they had supported spilled. The ground rumbled but the two men did not back away from the unspooling masses.

"It's done," Toby said.

"No."

Toby did not like it but his father was right. Quath came up behind them and said nothing. They all heard the thin cries of the subminds as pleasure-pains slipped into them. The Trigger Codes at work.

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The Mantis had been trying to stop the spread of the disorders all this time, and its despair and agony came intensely to the men, released by constellations of subminds which had finally given up. The thing was letting itself go in a final burst of bliss. Patterns danced and flared in its sensorium, spilling out filigreed and rich and meaning nothing to humans.

Toby stepped back and his own aching pain made him suddenly weak. "It'll be gone soon, Dad."

"No. Prang it once yourself."

"Let it go."

Cermo limped up suddenly behind them, one ear torn loose and blood down his face. His left arm dangled uselessly and showed white bone but Cermo's face was whiter. Toby remembered instantly when Killeen had lost arm function to a mech long ago, and the way Cermo had paid it no attention out of respect, except when Killeen truly needed help.

Cermo's sensorium rang with medical alarms. Cermo paid them no attention and Cermo did not look at Toby or Killeen or Quath either. He hobbled up and took Toby's weapon in a hand caked in brown blood. Cermo staggered with the weight of it and nobody said anything.

There was no sounds except the Mantis still stirring. From it whirred smears of information and into Toby came one clear voice.

Here is all I can give.

"Kill it," Killeen said. Cermo blinked, dazed. His right arm half-lifted Toby's sharp-darter. He seemed stunned by the sudden intensity of the voice.

I am more than the sum of all memories.

Cermo lifted the sharp-darter and pointed the snubbed snout at the center of the still seething Layers. The mainmind was in there somewhere. He weaved, unsteady. The moment hung in the air.

I saved so many Bishops.
I have the greatest collection of you.
And you are the most
splendid of all the lesser forms.

Cermo jerked into life. He fired three times. Even singlehanded, at this range each shot found its way into a submind and sparked a hard yellow flare in the Mantis sensorium. Each time Cermo swore angrily and the Mantis rocked with the impact.

The third one made the parabolic antennae whirl around very fast and faster and then stop. Toby knew he would remember the silly look of that.

Every sliding rod and servo in the Mantis halted and the dignity went out of it in a way he could not voice. One moment it was huge and suffering and then it was just a big pile of shattered parts. No whole.

Cermo fell then. He came down completely slack, arms loose and knees buckling. Toby saw that the Mantis had done some last thing and the aura of that burst hit him, too. It gave him a prickly jolt all over. His sensorium fused, tilted, flashed with working veins of amber. He staggered but the pulse did no damage.

By the time he reached Cermo the heavy-lidded eyes had closed.

"Damn!" Killeen said.

<He is suredead,> Quath said.

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<The Mantis stripped his self away in the last moments.>

"Why?" Killeen demanded. His voice was strained.

<I do not know.>

"Revenge," Killeen said.

<It had finished with you.>

"With us? Other way around," Killeen said bitterly.

<It played out its own end by allowing you to express one of your embedded patterns. One it had not experienced.>

Toby's voice was a croak. "What . . . pattern?"

<Your species hunted long ago across far terrain. In groups you large mammals mastered language and the rituals of pursuit. It led to your intelligence—a particular kind of mind.>

"It wanted to see us do that?" Killeen was quiet now, kneeling with his hands uselessly rubbing Cermo's shoulder.

<I suspect it wanted to be part of it. The only part it could play.>

Toby thought about the stored memories it had shed into the air, its treasure evaporating. But memory was not yourself, he saw. It could not drive forward, act. Memories just sat and waited.

6. Paths of Glory

The timestone tossed and broke and they spent a long time then just clinging to whatever stable places they could find. They did what they could for Cermo but that wasn't much. Killeen opened Cermo's spine and swore. "They're burned."

"How?" Toby asked.

"Mantis must've worked down through all his inboards."

"I thought our chips were protected."

"So did I. But our tech is old and mechs never stop learning."

Killeen said this heavily and with the respect a combatant had for another. Cermo's cylinder spinal chips had carried the older Aspects and Faces from Bishop history. A sure-death reduced the present, subtracting one life. Chip charring carried that loss far back into a dim past, plundering the origins of the Family itself.

It was hard finding enough real ground to bury Cermo. They stripped away his gear and divided the mass out for taking back. Most of it was useless but to leave it would draw mech scavengers.

Utter darkness came for a while and they slept. It did not do much good for Toby and when he woke a gang of scavenger navvys had found the Mantis. He heard them cutting and clattering around and went up the slope to where they worked in the sprawling shambles. He remembered how the parabolic antenna had spun around like an eye searching madly and how the majesty had gone then. The flanks of it were gone too now, carried off by the scavengers. The mechs had their own ecology of a sort, recycling machined parts and whole intact auxiliaries. There was no more Mantis, just intricate assemblies slewed out of their mounts, and gear he could not understand fried by vagrant pulses. The navvys picked over the carcass where crystalline lattices had carried the Mantis intelligence.

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There were navvys of all sizes, scooters and jakos mostly, and they worked remorselessly in teams. When they were done they would leave nothing.

He shot three and that scattered them for a while. The anger in him had boiled out and he felt stupid when Quath and Killeen came running, their sensoria projected out in a defensive screen. He just shrugged. His father nodded. Killeen looked at the Mantis for a while with nothing in his face and then pulled a few of the arc struts free.

When Toby walked past the inner cells of the Mantis he saw a mag storage kernel hung partly disconnected from the frame. He took it. He told Quath he wanted the energy store, but he carried it with him on the long march away from there without discharging it.

<You have something more than that,> Quath said as they headed downslope.

"The memories it sent?"

<I received none.>

"How'd you know I did?"

<By your actions. It chose you.>

For a searing moment he wished that he had never seen the Mantis. "I don't want that."

<They are in you now.>

He walked on in silence.

His father carried some of the beautiful arc struts strapped to his back despite the weight. Killeen was smiling and tired and said, "Plenty Bishops will want a piece. It killed a lot of us."

"How many?"

"It's cut through generations of us. Nobody can do the count. None of us has lived through the full time of it."

"We were trying to kill it, too."

"Yeasay. Had to."

"Murder on both sides."

"Now there is, yeasay." His father squinted at him and looked away.

Toby kept pace with Killeen behind Quath. They loped across timestone that had settled down. A golden glow seeped up through it and cast shadows up his father's face from the chin. The silence between them simmered until Killeen said, "It made art works of us. Hunted us. Sucked us up as suredead."

"Cermo made a mistake."

"I suppose."

"Coming on close to it at the end like that."

"Have it as you like."

They walked a while with the excitement going out of them and the only sound was their servos.

"It cared about Bishops, y'know."

"Cared plenty. Cared enough to hound us."

"Not what I meant."

"I know, son."

The Bishops had lost something too when the Mantis went out of their world but Toby could not say to his father what that was. He would be a full man before he came to understand it or to know that he had brought away from the Mantis not only the magnetic kernel—which he kept for years and never got around to discharging—but also a discord of loneliness which would go with him even when he was surrounded by Bishops.

After some hard marching they found a Bishop camp. The news

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spread quickly and more Bishops came hurrying across the stretches of timestone. They saw the curved Mantis struts that Killeen had carried out on his back and insisted on standing them up in an arch for display. Together like that they looked fine in the smoldering ruby glow of the timestone.

People crowded around the struts and touched them carefully. Killeen had a liquor toast from some of them and then another and talked freely. Toby stood back and watched as his father and himself and Quath were transformed into heroes by the excited chatter of the crowd who had not been there.

They had lifted a burden and legend from the Bishops and he knew with one part of himself how he would feel if someone else had done that. But it was different to have done it yourself and nothing in the talk could change that or even explain it. Especially not explain it.

Killeen said to him a little later, "Wish Cermo could be here."

"He is," Toby said and in that moment felt what the Mantis had sent into him in its last moments. Cermo. Truncated, flattened, seeping in spongy interstices of him, slivers and rivulets flowing in his sensorium and flavoring the liquid light, forever, Cermo.

He sent a whisper to Quath, —Why?—

<It was not from our kingdom of intelligence. We cannot know why.>

—Something like this. . . .—

<You can see it as a gift or a curse.>

—Or neither one.—

<You are two handed, two legged. Your minds favor dichotomies.>

—Not always.—

Toby said again to his father, his voice raspy, "He is."

"I s'pose," Killeen said. He squinted at his son and looked puzzled and took a drink.

They sat on little camp stools near the arch of fine struts and Toby had a drink then too, not wanting it but knowing that the moment needed it. He and Killeen drank from trail cups brought by a woman and her husband who had lost two children to the Mantis a long time ago. They wanted to talk to the brave ones and maybe to the heroic Quath, only Quath was not around anywhere. Toby drank carefully to hold onto the moments that were softening in him already, dropping away down the funnel of time and memory. He hoped he would not remember any of this last part of it and thought of the parabolic antenna instead, and the silly way it had spun so fast, and to his surprise saw it now with new deep eyes. ■

MOVING?

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THE REFERENCE LIBRARY Tom Easton

Living Within Limits: Ecology, Economics, and Population Taboos, Garrett Hardin, Oxford University Press, $27.50, 339 + x pp. (ISBN: 0-19-507811-X).
The Engines of God, Jack McDevitt, Ace, $21.95, 419 pp. (ISBN: 0-441-00077-0).
The Jericho Iteration, Allen Steele, Ace, $19.95, 279 pp. (ISBN: 0-441-00097-5).
Half the Day Is Night, Maureen F. McHugh, TOR, $21.95, 352 pp. (ISBN: 0-312-85479-X).
To Fear the Light, Ben Bova and A. J. Austin, TOR, $21.95, 352 pp. (ISBN: 0-312-85449-8).
Nimbus, Alexander Jablokov, Avon, $22, 376 pp. (ISBN: 0-688-1114-9).
Chaos in Wonderland, Clifford A. Pickover, St. Martin's, $29.95, 303 pp. (ISBN: 0-312-10743-9).
BOOKS ON DISK

One of my continuing concerns as a biologist is the growth of the human population on this planet. Current projections peg our numbers in 2050 at between 10 and 12.5 billion, assuming that the growth rate continues to decline (if it continues at the present level, we'll hit 14 billion in 2050). Unfortunately, the production of grain (the bulk of human food) is already leveling off and seems very likely to decline. The basic facts are apparent in the Worldwatch Institute's *Vital Signs 1994* (W. W. Norton & Co., ISBN: 0-393-31182-1) and the World Resources Institute's *World Resources 1994-95* (Oxford University Press, ISBN: 0-19-521045-X).

The inevitable result will be a growing decline in food per capita, leading to massive famines, disease, and social unrest, including war and immense migrations of refugees (one estimate says there may be 150 million environmental refugees in 2050, compared to 10 million today; this does *not* include political refugees). The tactics necessary to avoid disaster are so drastic—mandatory sterilization after one child probably would not suffice, since a third of the present population is under the age of 15—that they are unacceptable to almost everyone.

I do not think the human population will reach 10 billion by 2050. Disaster will strike well before then, perhaps in the 2020s or 2030s, and the so-called pro-life position ("We need more babies!") will prove to be more "pro-death" than anything Hit-

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ler or Stalin ever did.

If you think such thoughts too bleak to be true, you should read Garrett Hardin's **Living Within Limits: Ecology, Economics, and Population Taboos**, published in 1993. He lays out the facts very clearly, as well as the myths that have kept us from acting when there was still time for less drastic measures to work. One of those myths is the standard economics view that there are no limits to resources and growth can be sustained indefinitely.

Another myth, he says, is the science-fictional faith in technological progress, which so many believe will always bail us out just in time. I'm fond of this particular myth myself, but it is very true that Earth's resources are finite and growth cannot go on forever.

Still another is the taboo on discussing matters of fertility and population and control in realistic terms. Sadly, this taboo means that his message will not reach those who need it most.

Jack McDevitt assures us that by the end of the twenty-second century, humanity will have weathered the crisis of overpopulation and finally become spacefarers, venturing out among the planets and the stars to face a universe of puzzles. There is a strange statue on Iapetus, moon of Saturn. There are precisely shaped and fire-scarred cubes orbiting the one world with a living alien civilization. There is Oz, a fake city all straight lines and right angles, also fire-scarred, on the moon of Quraque, a world that once had natives but now has only ruins. And there is in those ruins a hint that civilization-destroying disasters have recurred every 8,000 years.

This is the background to **The Engines of God**. McDevitt's characters are archeologists busily engaged in excavating a Quaraquan ruin, searching for a Rosetta stone that will help them decipher an ancient tongue. They are rushed, for another agency of Earth is set to begin terraforming the planet to make a new home for humanity, and the process will destroy everything. At nearly the last moment, deep in the bowels of a submerged temple, they find a picture of the same sort of being represented by the Iapetan statue. There is a link here to the Monument-Makers, great promise, greater urgency.

Messages are sent. Richard Wald, dean of the exoarcheology field, is summoned. Priscilla Hutchins, Hutch, is engaged as his pilot. Wald tries fruitlessly to persuade the terraformers's chief to delay the blast that will destroy all hope of knowledge. A visit to Oz reveals an enigmatic pointer that just may be a clue to finding the Monument-Builders. Excavation plunges ahead under the looming deadline and despite a disaster deliberately arranged to convince them to leave early. There is success, but there is also cost, for at the very last moment Wald dies.

The survivors, including Hutch, soon embark on a quest for the home of the Monument-Builders and find another world of ruins, another flame-scarred Oz, colossal technology, several hair's-breadth escapes from disas-

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ter, more deaths, and answers to why so many rectilinear monuments were built. There is, it seems, something that sweeps through space with an eight-millennia rhythm and attacks anything that looks artificial. And yes, it has visited Earth in the past, and it will again.

I don't think that says too much, for McDevitt plants plenty of clues to let the reader catch on long before his characters. Yet perhaps it is too much—for me to say, and for McDevitt to give away too early—because *The Engines of God* is a puzzle story above all, a quest whose goal overshadows everything else, even the questers. If it should be compared to the work of any other writer, that writer is Hal Clement.

Like Clement's, McDevitt's characters are developed only a little more than is needed to carry their roles. Readers who wish more flesh on literary bones may therefore not enjoy this tale. Those who love puzzles will, for the puzzle is one of grand significance and the characters are, after all, sufficient unto their roles.

Allen Steele, already well known for *Orbital Decay, Clarke County: Space, Lunar Descent*, and *The Labyrinth of Night*, shows once more that he can write a real page-turner, though this time he brings the action very much down to Earth.

The Jericho Iteration's setting is St. Louis, Missouri, some time after the nineteenth century New Madrid earthquake finally repeated to devastating effect. Rebuilding has concentrated on the wealthier neighborhoods, whose residents are rated better able to pay off government loans. The city is occupied by the goon troops of the Emergency Relief Agency, who brutally suppress the poorer folks and neighborhoods. Right-wing politicians are angling for power. The *Big Muddy Inquirer*, the newspaper at which protagonist Gerry Rosen is a not-so-hot-shot reporter, loves to gripe and is therefore in something less than good standing with the ERA.

When the novel opens, Gerry is dodging ERA gunships in an abandoned slum. How did he get there? That tale began when he received a mysterious message on his semi-intelligent palm-top computer, urging his colleague John to meet someone. When he can't reach John, he goes to the meet himself but gains only a message telling John to attend a new meet the next night, at a bar near the office. He scratches his head, passes it on, and goes on with trying to make sense of his life. Unfortunately, that night his friend is killed.

Gerry snaffles a key bit of evidence, the disk in the slot of John's palm-top, but before he can make any sense of the mysterious files that fill it, ERA goons burst into his apartment, confiscate everything in sight, and frog-march him to the local dungeon, where the big honchos tell him of the dastardly deeds the mad scientists of the Tiptree Corporation are up to, inflame his BS detector, and turn him loose.

By this point, the experienced reader has a pretty good idea of what is going on. There's an artificial life

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form (a "sinister" one according to the book's blurb) loose on the net. Right-wingers are up to their usual nefarious tricks. And it's up to one lone, brave, whistle-blowing reporter to save the world.

That's not exactly an astounding novelty—there really aren't many such in this business—but Steele handles it well and keeps the story moving quite well enough to hold the interest. The major flaw is a tendency to make the villains rather more stupid than seems quite likely; on the other hand, if they were a bit smarter, the story either would not exist or would take much longer to tell and thus be less of a page-turner. Oh, the sacrifices authors make in the name of craft!

Maureen F. McHugh made a splash with her first novel, *China Mountain Zhang*, set in a China-dominated U.S.A. The setting was marked by a dramatic shift in sociopolitical conditions, but she was careful to indicate a history that might plausibly have created that shift. The reader had little difficulty accepting the story's world. Nor was there any trouble with the characters, for McHugh showed enormous talent in bringing her actors to life.

Half the Day Is Night is a good deal wetter (which is *not* to say it's all wet) but much less splashy. The setting is an urban culture buried in the bed of the Caribbean Sea and modeled on the cultures seen today on the islands in the Sun, especially Haiti. There are secret police—the Uncles or Tontons—looking over everyone's shoulder. There are echoes of a colonial past. There is terrorism, expressed as the assassination of business executives.

Meet Mayla Ling, banker. Her insurance company insists that she have a bodyguard. She has Tim, but they have too intimate a past for such a relationship. She hires David, an ex-soldier with experience in the South African wars and not much taste for his new job, too close to violence, in too alien a realm.

Mayla has a shot at a very big deal. To get it, she believes, she must countenance a smaller, illegal, nasty deal, a form of graft, corruption that tells us something about the underpinnings of Caribbean culture. A bomb shows up in her mail. David recognizes the danger (as Tim would not have done) and gets everyone out of the house in time. Then he flees, convinced he's not the man for the job, the job is not for him. This of course arouses police suspicion.

Before long, Mayla finds that she has in her bankerly zeal engineered a disaster for her bank. She resigns, seeks permission to go to the States, is refused, and decides she is as much a suspect as David. She too flees, and the last third of the tale concerns her reunion with her bodyguard and their search for escape from their undersea prison.

I found this one less satisfying than *Zhang* for at least two reasons. The first problem was Mayla, who struck me as far too weak and incompetent to have reached her level in the bank, even considering that her grandfather was the bank's founder. The second

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was the setting; it was well realized, and the culture felt real, continuous with the familiar, precisely as is necessary to make a science fictional world believable. But—despite a hint that the world is in the throes of overpopulation—there was no rationale for the existence of the undersea cities. Building them had to be colossally expensive, capital-intensive, high-technology projects; I found it very difficult to believe that they could be even remote options for third-world countries with meager prospects. This seriously weakened my ability to suspend disbelief.

On the other hand, I kept reading, gripped by McHugh's story-telling skill. She's good enough to impress even a carping critic.

In *To Save the Sun*, Ben Bova and A. J. Austin posited a moribund interstellar Empire of the Hundred Worlds faced with the challenge of reviving Earth's sun. The necessary technology was found and the project was initiated, while the Emperor and his son, Javas, struggled to overcome human, political obstacles. If one sensed a certain pertinence to modern America, well, Ben is known as an advocate of space exploration, and the human, political obstacles to that challenge definitely need overcoming.

Does the pertinence continue in the authors' sequel, **To Fear the Light**? Well, it has been suggested that if America were to embrace a huge technological challenge such as the colonization of the Moon or Mars, technology would be stimulated, morale would be boosted, and we would stride forth into the bright light of the future, ready to. . . . At the same time, of course, there would remain those who crave to gain power by encouraging people's fear of the new and unknown. They fear the light of the future and would drag us all back into the cave.

To Fear the Light is set some two centuries after *To Save the Sun*. The project, which involves setting up a wormhole link to channel the substance of a young star into old Sol as fresh fuel, is near fruition, the moment when the link will be activated. Adela de Montgarde, the scientist who devised the technique and married Javas, has awakened from coldsleep to witness the culmination of her labors. The current emperor is her son, Eric. An old colleague, the alien Oidar, is in coldsleep on Mercury. The mysterious Jephthah is stirring up hatred for Oidar's folk, doing his best to turn the people of the Hundred Worlds (now many more) away from the light, and gaining support even among the Imperial bureaucracy.

The reader is thus not surprised to see mutiny at the Mercury station, with Oidar and his scientist friend falling into Jephthah's hands. Nor to see word of the discovery of a new race of aliens appearing in one of Jephthah's propaganda broadcasts, suitably warped to make the aliens seem a nasty, evil threat. Nor to see Jephthah's apparent minion infiltrating Imperial security to be close to Adela as she goes to the new aliens' world.

The end is never in doubt, though

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the authors do draw the suspense fairly tight before allowing light and right to triumph. Yet suspense is not the point. This is a morality play of very classic form, saved from excessive over-simplification by showing the struggle of very modern Australian Aborigines to rediscover their roots, thus demonstrating that it is possible to combine love of the light with a thorough respect for tradition, even "primitive" tradition.

To Fear the Light is a morality play that should be read by a great many people outside the SF world.

Alexander Jablokov displayed immense talent in *Carve the Sky* and *A Deeper Sea*. In his latest novel, **Nimbus**, he is less showy—no carven asteroids or whales flying to Jupiter—but just as impressive as ever. The time is the next century, some time after the "Devolution Wars" mangled the old political order. The man who during the wars was Theo Bronkman, a member of a group (Nimbus) dedicated to rewiring brains to provide new abilities and switch loyalties, is now Peter Ambrose, jazz pianist and free-lance brainware ("virt") implanter.

Peter long ago suppressed his memories of the war years and the group. But when he wakes one morning, his news-scanning computer has displayed the hologram of a body beside his bed. It's one of his past colleagues, murdered, and when Peter visits the morgue to pay his last respects, he is just in time to see another old friend blow the first one's body to goo.

What is going on? The mystery deepens and grows urgent as other members of the Nimbus team are murdered. The wide availability of virts and mind/body editing makes it almost impossible to figure out who anyone really is and what is really going on. Yet it soon emerges that the villain may be the man who once ran the Nimbus group, dominating its members in much the way of an abusive father—except that he is dead. Has he returned from the grave? Might he be embodied in the virts Peter recently implanted in the brain of the executive who turned out to be his ex-wife's husband? And why is an icy luke (a leukocyte or cop from IntraCranial) on Peter's tail?

Nimbus is a nice, fast read, and if the technology isn't brand new, Jablokov pushes it to the limit to give us a reality almost a rubbery as anything the virtual cyberpunks have managed.

Clifford A. Pickover has received a good deal of attention for his computer graphics and has written *Computers, Pattern, Chaos, and Beauty* (1990), *Computers and the Imagination* (1991), and *Mazes for the Mind* (1992), as well as numerous papers. He loves the chaos of mathematics, fractals (the famous Mandelbrot set), and chaotic attractors.

In his latest book, **Chaos in Wonderland**, he tells us of the Latoocarfians of Ganymede, strange beings that have electronic brains and rate themselves according to the beauty of the chaotic attractors they can generate. He explains what mathematical chaos is, reveals how to write a simple BASIC program that will generate these patterns and discusses the sort of high-level graphics processing necessary to

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generate the wealth of images with which he illustrates the book.

This serious core of the book—an appealing introduction to chaos math—is broken up by chapters on the nature of the Ganymedean environment (an internal air pocket) and Latoocarfian biology, ecology, and sociology. He then gives us a rather dismal novella about the wanderings of a man and his pseudo-human girlfriend through Ganymede in search of specimens for a private zoo. Their aim is to kidnap the Latoocarfian king as the ultimate specimen. The dialogue is so stilted and artificial that it seems to come from another century (for instance, " 'This is a Ganymedean fractal spider!' I said as I slapped my side. 'They're supposed to have legs upon legs upon legs. . . .' "). The romance is even worse (" 'Garth, do you think our sexual organs are compatible?' Kalinda asked."). I congratulate all readers who can slog through to the appendices, where Pickover gets interesting once more, with fractal games, the 100 strangest mathematical titles ever published, lists of further reading, and brief reviews of a number of products, including software for generating fractals and simulating astronomy.

The book's many illustrations make it a lovely package, but it is something of a catchall. It has its points, but the novella is not one of them, and it is also marred by far too many typos. The book seems worth its price only if you are a chaos/fractal freak or if you wish to give some such person a gift they will love.

A few months ago, I said I would soon be reviewing Hans Moravec's new book, *Mind Age*. Well, the review's written, but I can't use it. His publisher, Bantam, canceled the book at the last minute, "in an internal downsizing." He is now looking for a new publisher. When he gets one, I'll let you know.

BOOKS ON DISK

The sixteenth issue of *The Electronic Publishing Forum* ($6, $12 for four-issue subscription, Serendipity Systems, P.O. Box 140, San Simeon, CA 93452) is out, and it's worth a look for two reasons. First, editor/publisher John Galuszka has tested the technology for converting photos, line drawings, and pastels into images that can accompany electronic publications, and the result is impressive. Second, this issue includes descriptions of the Association of Research Libraries' *Directory of Internet Journals, Newsletters, etc.* ($54 + $5 s&h on paper, $36 on disk) and of Samizdat Express's wealth of on-disk textbooks (classics, history, science, math, government, etc.), literature, and reference materials obtained from the Internet and available for a mere $10 a disk. There is also an interesting article on and demo of personalized, interactive electronic books.

The Samizdat material especially seems a must-have for any library that pretends to meet the needs of the blind, for most of the material is apparently compatible with speech synthesizers. If you wish to go directly to the source, contact Richard Seltzer, the B&R Samizdat Express, P.O. Box 161, West Roxbury, MA 02132-0002, 617-469-2269, samizdat@world.std.com, and ask for a list of what's available. ■

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BRASS TACKS

Dear Dr. Schmidt:

My husband has been reading *Analog* for more than forty years. Tonight he showed me a letter from Harold Hamblet (August 1994) who is concerned, and rightly so, that his sons' recommended reading lists contained only one science fiction suggestion. I regret that the teacher seemed so disinterested (and perhaps uninformed) because there are many books in this category that should be on a recommended reading list for students this age. At Georgia State University, I teach a graduate course, *Teaching Reading in Middle Grades* (Grades 4-8). One of my goals in this course is to make teachers aware of the outstanding literature of all genres (poetry, fiction, nonfiction, fantasy, science fiction, etc.) for middle school students. I am enclosing a handout that might be of interest to Mr. Hamblet. As you see, I have grouped fantasy with science fiction. I would be delighted for Mr. Hamblet and other readers to send me the names of additional books that could be included on this list.

ANNE CRANE

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Secondary Education
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FAX 404-651-2546

NEWBERY MEDAL RECIPIENTS

A Wrinkle in Time (1963) by Madeleine L'Engle (ages 9-12).

The High King (1969) by Lloyd Alexander (ages 10-12).

Mrs. Frisby and the Rats of NIMH (1972) by Robert C. O'Brien (ages 10-12).

The Grey King (1972) by Susan Cooper (ages 11-young adult).

The Hero and the Crown (1985) by Robin McKinley (ages 12-young adult).

The Giver (1994) by Lois Lowry (older adolescents, thought-provoking look at a futuristic society).

NEWBERY HONOR BOOKS

A Ring of Endless Light (1981) by Madeleine L'Engle (ages 10-12).

The Blue Sword (1983) by Robin McKinley (ages 12-young adult).

Graven Images (1983) by Paul Fleischman (ages 10-12).

Sweet Whispers, Brother Rush (1983) by Virginia Hamilton (ages 12-young adult; African American fantasy).

In the Beginning: Creation Stories from Around the World (1989) by Virginia Hamilton (ages 9-young adult).

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NOTABLE AUTHORS

Asimov, Isaac. *I, Robot* (book that foresaw the role of robotics in modern societies).

Babbitt, Natalie. *Tuck Everlasting* (ages 10-young adult; story about immortality).

Bradbury, Ray.

Clarke, Arthur C.

Cooper, Susan. *Over Sea, Under Stone* (ages 10-young adult; first of five-book Arthurian quest series).

Dahl, Roald. *James and the Giant Peach* (ages 8-11); *Charlie and the Chocolate Factory* (ages 8-11); *Merlin Dreams* (ages 10-young adult).

Hamilton, Virginia. *Justice and Her Brothers; The Magical Adventures of Pretty Pearl* (both books: ages 11-young adult).

Heinlein, Robert A. *Tunnel in the Sky* and *Podkayne of Mars* (Both are based on known scientific facts and explore the technology of the future).

Kesey, Ken. *Little Tricker the Squirrel Meets Big Double the Bear* (ages 8-11).

Kipling, Rudyard. *Just So Stories* (ages 6-10).

Le Guin, Ursula. *The Farthest Shore; Tehanu: The Last Book of Earthsea; The Tombs of Atuan; A Wizard of Earthsea* (all books 11-young adult).

L'Engle, Madeleine. *A Swift and Tilting Planet* (ages 11-13).

Lewis, C. S. *The Lion, the Witch, and the Wardrobe* (ages 9-12; first in a series of quest fantasies).

McCaffrey, Anne. *Dragonsong* (ages 11-young adult).

Sleator, William. *House of Stairs; Interstellar Pig* (both books: ages 11-young adult).

Tolkien, J. R. R. *The Hobbit* (ages 10-young adult).

Verne, Jules. *2,000 Leagues Under the Sea* (prophesied submarine travel).

White, E. B. *Charlotte's Web* (ages 8-11).

Yolen, Jane. *Dragon's Blood* (ages 10-13).

Dear Dr. Schmidt,

In regards to the story "Dear Colleagues" in your September 1994 issue: Where do I sign up?

LARS W. COLIN

Taft, CA

The author replies....

Where is on page 111, the next to last paragraph. Big question is *when.* After they finally build the SSC, watch *Science News* for a story about some kind of accident in the detector chamber. In the meantime, be working on the plans for the part *you* want to build.

TOM LIGON

Dear Stan,

Sheesh. They're not alien spaceships, they're cats toasting marshmallows—Kitty-Puff Gamma-Mallows™. And Figure 4—September, 1994, page 61—shows one Kitty-Puff Gamma-Mallow™ that gradually burned out all by itself (upper left); one that flared up after a brief while (upper right); another that popped and puffed (lower left); and—to prove our hypothesis—on the lower right, a Kitty Puff Gamma-Mallow™ where the cat patted it with its little

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paws about four times before it finally went out. Here, we must disagree in a minor detail with Marian Powell's otherwise well-taken points about cats (Brass Tacks, September, 1994).

It's not the Anthropic Principle that rules our paraverse, it's the Isotropic Felinity Principle. Anybody who knows anything at *all* about cats knows that they get into everything, including being distributed evenly across nearby regions of the Galaxy (Figure 1, page 54). Why do you think it's called the MILKY WAY??? Moreover, everybody knows that chairs and sofas exist solely to allow cats to sharpen their claws, and the more expensive the upholstery the better. So now we know what black holes are. Space cats scratch them in the fabric of space time. But the final proof is the existence of superstrings. They're all tangled up. Could the evidence be more obvious than *that?*

These are, we assume, the offspring of the very same cats about whom H. P. Powell pointed out years and years and years ago that they left their paw prints in the soft dust of the Moon (Brass Tacks, ASF, July 1959, pages 140-142).

TIMOTHY PERPER
MARTHA CORNOG

Dear Stan:

The basic driving force toward a future rich with possibility is truly new understandings of nature that make possible all sorts of things we could never plan. Right now there is strong political movement in this country that would gut the kind of research that gave us electricity to put money into the kind that will get us better toasters. We cannot afford to develop one kind by destroying the other.

NASA is in deep but quiet trouble. At this moment, I am hearing praise of the shuttle's Hubble Space Telescope repair mission. This is the most well-known example of a group of orbiting observatories trying to use the lack of atmosphere to observe the Universe in gamma-rays, X-rays, ultraviolet, infrared, and microwave. The latter got brief but intense attention about two years ago when it discovered fluctuations in the cosmic microwave background, the imprint of the seeds of all the structure we can see. (Things related to this happen to be my specialty). Then there are the planetary missions, exploring the contents of our Solar System, the human-oriented space station, and traditional aeronautics research. Due to budget pressures felt by all agencies, NASA is cutting back. One current idea is to shut off successful orbiting observatories after a year or two, no matter how useful they are. This is driven by profits: the contractors who build them don't make much money from them actually being used, but only from building them and launching them. Winners include aeronautics research and the space station, which they are determined to keep alive. I support building some sort of space station, but not for scientific reasons.

Potentially the most dangerous in terms of the effect of changes underway is the National Science Foundation, the only agency whose primary mission is to see that fundamental research gets done in this country. It

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is applied research that brings short-term gains to industry, and produces products and technologies that improve our standard of living. Formerly, our business community did a good job of sponsoring research, and we have benefited greatly. During the '80s, the emphasis on making profits changed from selling quality merchandise to mergers and acquisitions, the whole disastrous shell game for which the bill is now coming due. In this environment, it makes no sense to fund research, since you won't own the company next week.

In a panic about this, and under pressure to do something, a group of people in Congress have been trying to redirect NSF to practical applications. Right now they are trying to redirect NSF funds to applied research. This could become law in the near future. But even without that, NSF is feeling the heat and beginning to respond. They are trying to salvage their mission by targeting "strategic basic research," still proposer-initiated but in areas that are believed to be economically useful. Since the number of people who understand the benefits of science is small, and the number involved in doing research is even smaller, legislators get very little mail from their constituents about it; even a small increase is effective. That is why I am appealing to the readers of this magazine.

If we look back to the 19th century, we can identify strains that led to important modern technology. (1) The electromagnetic research led by Faraday and Maxwell gave us now-familiar devices such as electric lights, telephone, electric motors, radio, TV. All this work was of no obvious social value at the time. (2) Astronomers seeking to understand light coming from the stars built a database of spectra, which led to quantum mechanics and our understanding of atoms, making modern chemistry possible. This theory is also at the basis of most present "new technology" based on lasers, miniaturized electronics, etc. (3) The monk Mendel, curious about why and how pea plants inherited flower color and other characteristics, laid the foundation for modern genetics, with a genetic engineering revolution now getting started—based on 2 and 3 combined.

What would have constituted "strategic basic research" in 1880? Any scientist whose basic work had anything to do with the formation of boiler scale in steam engines would have an edge. Factory power was usually belt-driven, so anything in mechanics relating to belt-drive efficiency would be big. Telegraph was clearly important, so a major effort would be mounted to get telegraph stations in every village, perhaps a set in every house. Any coding work offering a new, efficiently tapped-out replacement for Morse Code would be targeted as strategic. This would be called "The Information Super-Riverboat." Studies in buoyancy (and in producing hydrogen) would be extremely important, to prepare for the great 20th century air travel mode of balloons/dirigibles lying ahead. (Helium, the gas used for safety reasons in many balloons that do fly, is another discovery made in astronomy.)

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We can never know what is strategic more than a few short years ahead, which coincides with the next election. We therefore likely waste our money on strategic research, as the society of 1880 would have done. On the other hand, the return on basic research is high, *28%* interest according to a Congressional Budget Office report. The real pioneers of the last century could never have been funded in an environment that demanded quick applications, obvious before the research is done. Today's research is more expensive, but in an environment greatly enriched by past results.

Your letters to senators and representatives, particularly those on the Appropriations Committees, will be much more effective than they would be on almost any other public issue, by simple numbers. This is a time of crisis. Science needs your help.

The American Institute of Physics has a free brochure entitled, "Communicating with Congress." For a copy, send a self-addressed, stamped (29 cents), $4\frac{1}{4}$" by $9\frac{1}{2}$" envelope to:

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AIP also runs an electronic newsletter: send electronic mail to newfyi@aip.org.

Please write to your legislators. Not to act is to put at risk the common vision shared by the kind of people who read this magazine.

ADRIAN L. MELOTT

Professor of Physics and Astronomy
University of Kansas
Lawrence, KS 66045

Dear Dr. Schmidt:

Just thought I'd add a little tidbit regarding the September 1994 editorial, "Evil Spirits." Someone should point out to the fear-mongers that virtually *all* of the food we find in our supermarkets today is genetically altered. Size, flavor, yield, hardiness and nutritional quality have been continually enhanced since the inception of agriculture by whatever methods have been appropriate to the contemporary level of technology. In fact many plants have been altered to the extent that they are no longer self-propagating, or would revert to primordial forms if allowed to do so. Some of the most popular ones, corn for example, bear little or no resemblance to their ancestors of 10,000 years ago. No "wild" species has undergone any significant change as a result of natural forces within that period. It is to the hand of man that we owe our bounty; we would sorely be remiss to reject the fruits of our current level of technology, just because it is faster.

JIM HUSTON

Rushville, IN

P.S. I wonder what the local know-nothings said about the first neolithic farmer who held out his fattest, best-yielding grain for the next season's planting? Witchcraft!!!

Selective breeding is not quite the same as genetic manipulation at the molecular level, but it is tinkering and we've made extensive use of its benefits. ■

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UPCOMING EVENTS Anthony Lewis

31 March-2 April

CON-CEPT 95 (Montréal SF conference) at Holiday Inn Crown Plaza Metro Centre. Guests of Honour: Spider & Jeanne Robinson; Artist Guest of Honour: Vincent Di Fate. Registration: C$24 until 15 March, C$29 at the door. Info: Con-Cept, PO Box 405, Station H, Montréal, Quebec, Canada H3G 2L1.

31 March-2 April

I-CON XIV (Long Island SF conference) at Stony Brook, N.Y. Guests (tentative): Frederik Pohl & Nancy Kress, Julius Schwartz, Koichi Ohata. Registration: $25 (adult), $13 (student), $8 (5-12) until 28 February; $28 (adult), $15 (student), $10 (5-12) at the door. Info: I-CON, PO Box 550, Stony Brook NY 11790-0550.

21-23 April

Son of CON-TROLL (Houston SF & Fanstasy conference) at Ramada NorthWest, Houston, Tex. Author Guest of Honor: Katherine Kurtz; Artist Guest of Honor: Lubov; TM: Greg Bennett. Registration: $25 until 15 March, $35 at the door. Info: Con-Troll, Box 740969-1025, Houston TX 77274. (713) 895-9202.

24-28 August

INTERSECTION (52rd World Science Fiction Convention) at Scottish Exhibition & Conference Centre, Glasgow, Scotland. Guests of Honour: Samuel R. Delany & Gerry Anderson; Fan Guest of Honour: Vin¢ Clarke; TMs: Peter Morwood & Diane Duane. Registration: £80/US$125/CDN$160/DM210/DFl240, Supporting: £15/US$251/CDN$30/DM40/DFl45. At-door rates not set as of the time of this listing but will be greater than current attending rates. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Intersection, AdMail 336, Glasgow G2 1BR, UK or intersection@smof.demon.co.uk; Intersection, Box 15430, Washington DC 20003-4030, USA. (301) 345-5186 voice/fax.

You can send me e-mail about your convention—A.LEWIS20 on the GEnie™ network. When calling conventions for information—do not call collect and do not call too late in the evening. ■

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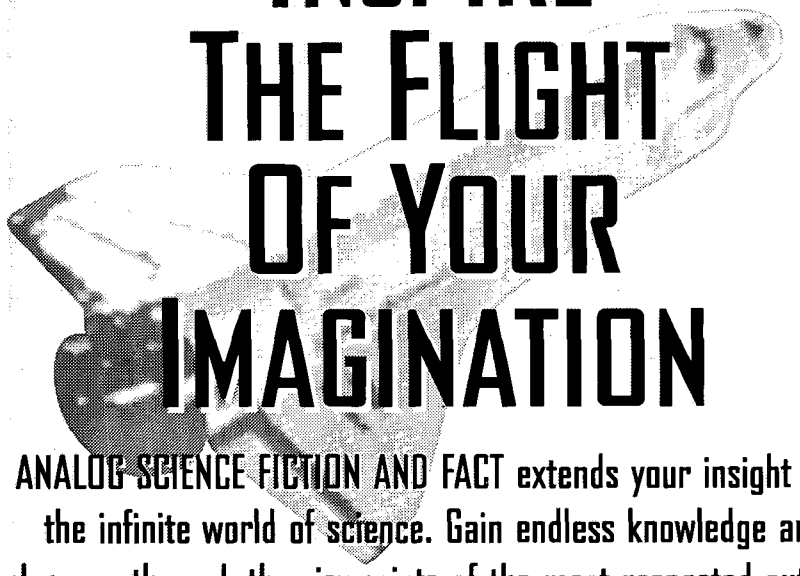

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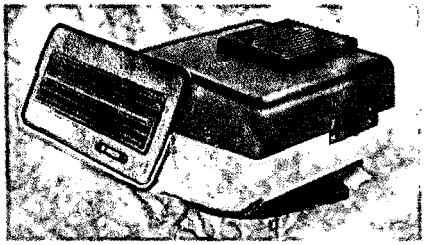

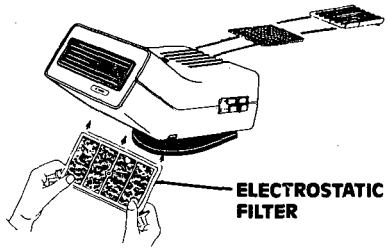

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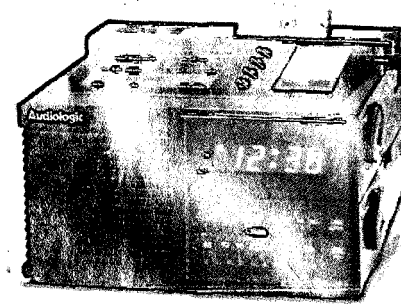

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